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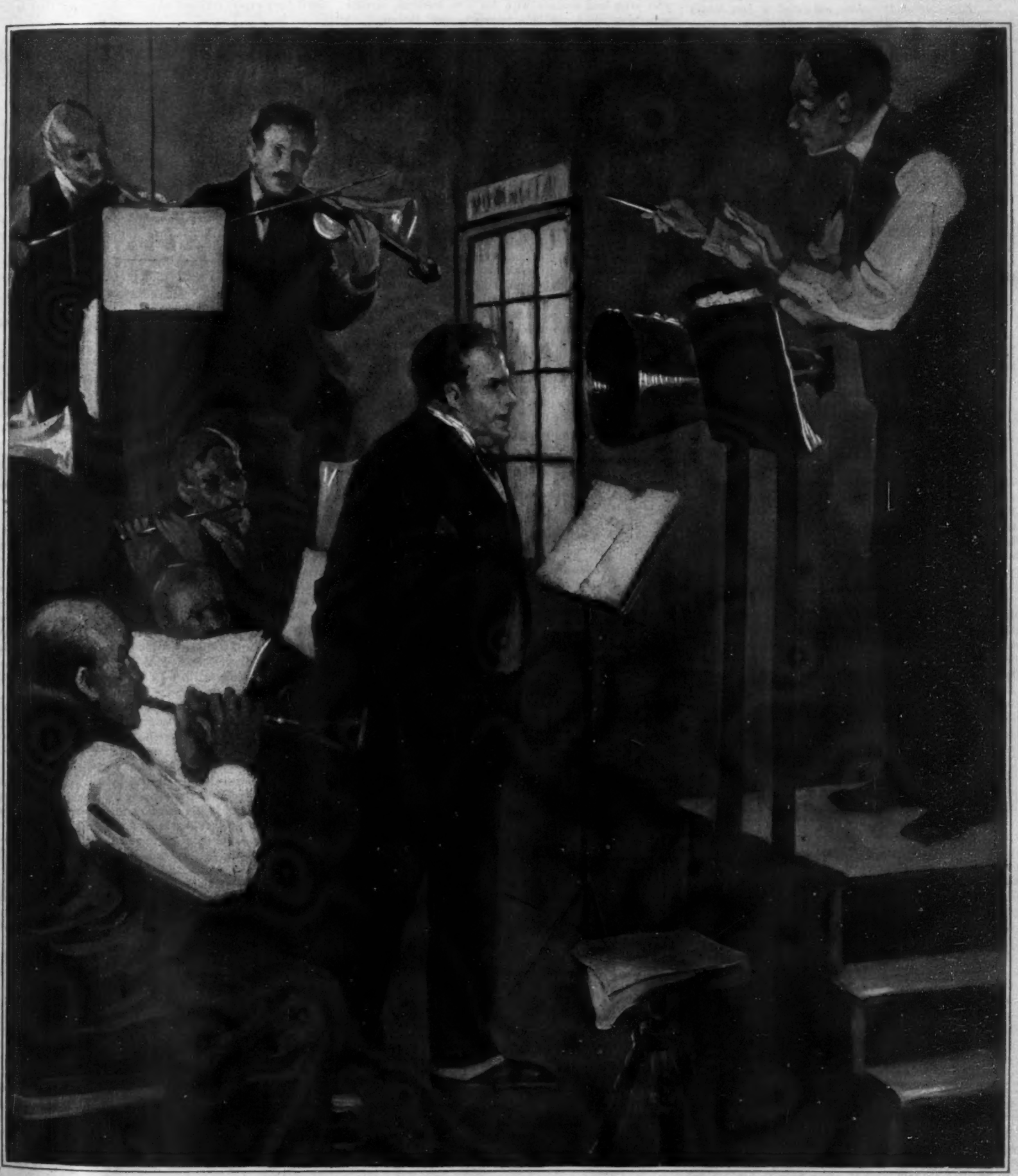

Singing for the master record at a phonographic recording studio [See page 164]

SCIENTIFIC AMERICAN

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

St. Patrick in the Patent Office

A LONG standing convention which seems to be breaking down under the assault of modern ideas is the once inflexible rule that a professional man may not advertise. The very fact that we are so generally receding from this extreme standard may be taken as indication of its too severe character; but it rested on fundamentally sound doctrine.

Above all, advertising must be honest; whatever the goods or services offered, they must be truthfully represented. If merchandise is advertised in false and misleading terms, the purchaser can check up the claims against the goods, before or after buying. The same thing holds in connection with the concrete services of the plumber or the carpenter. But with the professional man who advertises the case is different.

Shall we say the doctor is a fraud or a failure because the patient dies? Shall we denounce as a thief or a bungler the lawyer who loses our case? Shall we brand as incompetent or dishonest the teacher under whom our young hopeful fails in Latin or algebra? Patients die, cases are lost, students fail, under the best of treatment. Who shall ever say whether due diligence has been exercised, whether the fault lies with the party of the first or of the second part, or with either?

We must have faith in the doctor; we cannot question his conduct of the case. In return, any publicity indulged in by the professional man should be of the most conservative character. On the whole, the proper limits are well marked and well met. There are, however, fields in which this is not the case. One such is that of the patent attorney. Unscrupulous members of this profession have for years flooded the public prints and the mails with advertisements of the most outrageous sort.

First in its class is the announcement bearing the flaming caption "INVENT SOMETHING." Something, anything—it doesn't in the least matter what; any old invention is bound to bring you wealth: this is always the plain implication of the text that follows. And in case the unfortunate inventor can't think of anything to invent, his prospective attorney will even supply this deficiency.

It would seem sufficiently obvious that invention is not an act of will, like putting on one's clothes in the morning. Yet just as a man with a vast array of costumes might, on arising, consult a list to aid his choice, so some of the big patent practitioners publish pamphlets telling inventors "What to Invent." Two of them catalog, respectively, 448 and 319 more or less crying needs, and urge their clients to gain wealth by meeting one of these.

Is not this program of invention to order while you wait a charming one? The impecunious inventor gets up in the morning, consults the docket of suggestions, and decides to meet crying need No. 222. He devotes the morning to reflection, the afternoon to transfering his idea to paper, and by evening his application is in the mails. Next week he receives the delegations of plutocrats come to bid for his patent.

Much persuasive eloquence is devoted to convincing the reader that this last link in the chain of events is an inevitable one. An imposing array is cited of inventions that have yielded fortunes, from harvesting machine and telephone down to some trivial toy that paid its inventor $50,000 per year. The set prizes offered for certain inventions are featured strongly. If all the rewards ever set, and won, expired or withdrawn, were added, they would of course reach an imposing total; but no single offer now open amounts to any considerable sum. In the face of this fact, who can fail to detect the sharp practice in the caption "MILLIONS OFFERED FOR INVENTIONS"?

One enthusiastic pamphleteer lists fifty inventions picked "at random," all of which were money makers, and which averaged over $16,000 apiece. We should like to master this gentleman's scheme for random selection. It reminds us a good deal of a boyhood experience of our own, when a certain dealer in postage stamps made us one price for "picked copies" and a lower one for "run of the lot." We selected the latter alternative, but he undertook to give us picked copies anyhow—picked for poorness. We suspect that the identical same sieve thus employed for achieving a philatelic average is now in the hands that picked out these highly remunerative patents "at random."

The vicious feature of all this is that it is purposely done to instill the desire to invent—at so many dollars a chance—in persons whose minds are not inventive and who lack the necessary training for invention. Invention is just as much a profession as medicine or the law; it requires quite as much ability and preparation as these; a person without both has as much chance of success in the one place as in the other. The only exception to this statement is in favor of the man who, after long contact with his own business, invents something which can be successfully used therein.

We presume that if it were as simple a matter to secure a license to practice law as it is to get a patent that protects nothing, these same shysters would turn their attention to the issuance of such licenses. Doubtless they would then advertise the enormous fees earned by a Root or a Hughes or a Choate, and compile a list of fifty-seven different varieties of law for their victims to choose from. Doubtless, too, the patent attorney who offers what purports to be a guarantee that patents taken out by him will be sold, would present a prettily worded near-pledge to secure practice for all "lawyers" qualifying through him. And the gentleman who gets your patent on a contingent fee, and who accepts a worthless patent rather than forego that fee, would find a corresponding dodge in the new field.

But licenses to practice law are not issued to all comers. Nay, we can go further, and state that in the light of a recent regulation of the Patent Office, a license to practice before the Commissioner of Patents will no longer be granted to every Tom, Dick and Harry who applies for and misues the privilege. For the Commissioner has ruled that:

"Every attorney registered to practice before the United States Patent Office shall submit to the Commissioner of Patents for approval copies of all proposed advertising matter, circulars, letters, cards, etc., intended to solicit patent business. . . . Any registered attorney sending out or using any such matter, a copy of which has not been submitted in accordance with this rule, or which has been disapproved, shall be subject to suspension or disbarment."

We need comment no further on this regulation than to say that there has never been anything like it before, and that we hope it will be used courageously to clean up what has long been a stench in the nostrils of all persons interested in clean patent practice.

Disillusionment

ALTHOUGH it may hurt our pride to acknowledge the whole-souled manner with which we formerly accepted German propaganda as unvarnished truth, there is saving grace in the rapidity with which we are putting ourselves right. Chemistry is playing an important part in this, and its accomplishments form the subjects of a series of articles in a bulletin of the Chicago Section of the American Chemical Society.

The beet sugar industry affords as excellent an example of far-sighted German propaganda as has come to our notice. The idea of making sugar from beets, like most good ideas, originated outside Germany but was appropriated by that country. The first sugar from beets was made in France in 1870. The Germans were quick to appreciate the economic advantages offered and became prominent in the industry. They did much to develop varieties of beets which produce more sugar and are of higher purity which means that a greater percentage of the soluble solids is sugar. They specialized on sugar making machinery, patented processes, creating such a reputation for themselves that wherever the culture of sugar beets has been introduced the German has been found in the important places.

All this tended to make us dependent for an important item of food. An effort was always made to keep the technique in foreign hands, to discourage the growing of beet seed in America and to frown upon American made apparatus. Some small, vital part, such as automatic scales or slicer knives was made the last stand.

Things have changed. One great company at the suggestion of a German employee who, eight years ago, said, "When the war comes we ought to be producing our own seed," undertook that task and has been successful. Good seed is produced in America now and with what was secured from Russia and Holland to help along for the present we shall be able to continue the production which means more than ever before. American understudies of the old foremen have surpassed them in skill and now think nothing of teaching a boy of average intelligence manipulations at one time guarded as wonderful secrets.

There was a shortage of slicer knives soon after war came. The cutting edges of these knives resemble a series of Vs joined at the top (VVVVVV), are not easily made and have heavy duty to perform. A maker of American steel products was approached and he informed the beet men that 10 years ago he had made some knives only to be informed that they were unsatisfactory. The purchasing agent asked the superintendent what was the matter with these knives and the question was passed on with no real answer to be found. You see they had not been made in Germany. It is gratifying to know that better knives are now made here.

We have here a perfect sample of German trickery. We could have grown our own seed and made our own knives but so long as those under German influence were in power no one was allowed to believe it. Perhaps after all, we have no reason to be ashamed. We met them as fellow men and believed what they said just as we expected them to believe us. Hereafter they will have to come with petitions and affidavits and bonds and sureties if they expect civilized men to believe what they say.

"Garabed"

AND so, after all, it turns out to be nothing but our old friend the flywheel and its family of pulleys —that will-o'-the-wisp of the perpetual motion crank. After a Congressional Committee had made an investigation, a special act of Congress had been passed, and a committee of five scientific men had been appointed by the President to look into the invention and determine its merits, it was perfectly natural for the whole country to be keyed up to a high state of expectancy. Even the conservative press was betrayed into the expression that "There may be something in it." We ourselves expected that investigation would disclose an ingenious bit of mechanism; but it had not occurred to us that "Garabed" would prove to be one of the typical perpetual motion schemes of the well known type pursued by men who do not know the difference between power and force. Frankly, we are disappointed in Mr. Giragossian's lack of originality.

In a letter to the *Public Ledger*, James A. Moyer, Chairman of the Garabed Commission, gives some details of Mr. Giragossian's apparatus for the generation of "free energy."

The machine consisted of a heavy flywheel which could be set in motion by means of a system of pulleys. The flywheel was mounted in bearings in which friction was reduced to a minimum, and it was furnished with a form of electric motor driven by a small storage battery. The power generated was sufficient to overcome the friction of the machine and the wind resistance of the moving parts. The inventor claimed that the machine would start itself, but that it would take a very long time to run the flywheel up to full speed; and so it was started by a strong man by means of the pulleys and belts. After the machine was started, the battery was switched in and the machine would continue to revolve indefinitely—the flywheel running up to rim speed of about 100 feet a minute. The power of this machine then was measured by a device similar to a pony brake or power dynamometer which was loaded with weights until the machine stopped. From this the horse-power was calculated. Apparently it took only one-twentieth of a horse-power in the electric motor to keep the machine running, and it took ten horse-power to stop it, so that the inventor believed that he was actually producing energy. Evidently he was not possessed of even an elementary knowledge of physics, such as a boy acquires in High School, or he would have realized the difference between force and power. It should be perfectly apparent to him that the energy stored up in the flywheel was that put into it by the man. All that Mr. Giragossian did after running his machine for a time was to stop it suddenly and note how great a power was developed by expending in a few seconds the energy which it had taken minutes to store up. At the demonstration before the commission even the electrical mechanism was absent, and the inventor tried to demonstrate the flywheel effect without any auxiliary energy to overcome friction losses. Very naturally, the decision against him was unanimous.

Despite its ridiculous termination, this farce is not without its lessons. Mr. Giragossian's honesty of purpose is demonstrated beyond measure of doubt; but it seems absurd that in this day and generation a man with no better idea of the fundamental laws of physics can gain the ear of Congress and have a special measure passed through for the protection of his so-called "great discovery." The patent laws of our country are amply able to protect any honest inventor, and it was the suspicion of Mr. Giragossian that they would not give him this protection which led him to seek special favors from Congress. Such an attitude should have been discouraged, but Congress, by its unprecedented attentions, actually fostered these suspicions and cast a slur upon regular legal means of protecting inventors which are provided by the Patent Office. Had Mr. Giragossian applied for a patent in the usual way he would have been shown very promptly by the Patent Office the fallacy of his reasoning.

Electricity

A New Form of Experimental Cell.—In a recent paper read before the American Electrochemical Society, Mr. S. A. Reed describes a form of primary battery for experimental purposes. The electrolyte consists of fused borax containing manganese, while the negative electrode consists of broken carbon in contact with a graphite grid. The positive electrode is made of gold foil strip. The electrolyte in contact with the outer gold strips is oxidized by the air, and subsequently reduced by the carbon inside, mixtures of carbon dioxide and monoxide being formed at the anode. An E. M. F. in the neighborhood of 0.8 volt is stated to be obtained.

Adjustable Light for the Garage.—A very handy lamp especially suited for garages and shops where direct light is needed on the work has lately appeared on the market. The extending arm can be moved either up or down or swung either way on the pipe stand. It is positioned by notches in the collar. The universal joint at the end of the arm has a double movement with ratchet and swivel, which permits of placing the lamp at any desired angle. By removing the upright member of the stand and placing the arm over a short nipple on the base, a convenient floor lamp is obtained for use under automobiles. Some thirty feet of connecting cord are furnished with the lamp.

Wireless Between Holland and Her Colonies.—Various schemes have been started in the Netherlands for getting into wireless communication with the Dutch East Indies, that Holland might be independent of foreign countries for this very necessary service. The wireless station at Scheveningen is not powerful enough, reaching only to the neighborhood of the Mediterranean; and, according to experts, it would be next to impossible to enlarge its capacity. The Dutch authorities have accordingly selected a new spot for the erection of a very powerful station at Schoorl in Gelderland. This will be equipped with appliances that will make possible direct communication with Javan and Sumatran stations.

Fine Deposition of Metals.—According to the *Zeitschrift fur Angewandte Chemie*, a German patent has been taken out involving a new process for spraying metals on to surfaces of any kind. The metal to be sprayed forms one of the electrodes of an arc, and a blast of gas impinges on this electrode, directed, however, in such a manner as not to play on the arc and extinguish it. The gas used for the blast is of a non-oxidizing nature, and its effect is to carry away fine particles of metal, which can thus be deposited on any kind of surface forming a very thin skin. When polyphase currents are used the electrodes may either be convergent or so placed as to cross the streams of gas. In one form of the apparatus the arc is started by means of the instantaneous discharge from an auxiliary high-tension circuit.

Telegraphy Through the Ground.—Some months ago interest was excited in France by a report that the German army is using a method of communication known as "telegraphy through the ground." The method appears to be a compromise between wireless and one-wire telegraphy. The two communicating stations are not connected by wire. According to *Le Matin*, a wire is placed along the fighting front with both ends extending into the ground, and current from a Rhumkorff coil or kindred apparatus is conveyed along it. Installed parallel to this wire, and some distance in advance of it is another similar wire, in which current is induced by the first, thus permitting the sending of signals. The method is thus broadly similar to wireless, except that the ground forms the medium instead of the air. One would imagine, however, that although the method has the advantage that there are no intervening wires to be cut, it would be a very simple system to tap.

Enemy Wireless Stations in Our Midst.—Two secret wireless stations, one a powerful affair for sending located on a large office building inside the Chicago loop district, were recently raided by operatives from the Department of Justice. The second was equipped for receiving only and was on the north side. Investigation has revealed that the "sending" station was powerful enough to transmit messages to Mexico. One man connected with the work, when taken into custody, was found to be registered as an alien enemy. Two wireless operators were attached to the sending station when Government men raided the office installed on top of the downtown office block. They admitted they had been sending messages for some time, but declared they had no idea where they were sending them. They insisted they had merely been employed to send and they knew nothing more than this about the affair. They had a knowledge that the stuff they were handling had something to do with Great Lakes, they said. The sending station, continues *The Wireless Age*, was rigged up with wires which ran out on to the roof of the skyscraper and were attached to the metal frame of the building to make the necessary "ground." The receiving station was cleverly concealed in a room on the upper floor of a flat building. Several hundred feet of wire had been rigged up in the room, running back and forth to make the aerial.

Science

A Geological Handbook of Northern France has been prepared by Prof. W. M. Davis, of Harvard University, who recently published a "Handbook of Northern France" of more general scope. Both books are designed especially for the use of our soldiers "over there," and are approved by the geographical committee of the National Research Council. Copies are distributed free to the various cantonments, etc.

New Processes for Making Coke are being eagerly sought by the Government. The Bureau of Standards is making experiments with two procedures for coking high volatile coals, one developed at St. Paul and one at Canal Dover, Ohio. Either method if proved commercially practicable would increase greatly the output of by-product coke by permitting the use of coal heretofore considered unsuitable for coking. Laboratory tests have been practically completed, and the Bureau of Standards is about to take over temporarily operation of the Canal Dover plant in the endeavor to see just how the thing works out on a commercial basis.

This Year's Meeting of the Scientific Societies.—The American Association for the Advancement of Science and the national scientific societies affiliated with it will meet in Baltimore, Md., under the auspices of the Johns Hopkins University, from December 27th to 31st, 1918. It had been originally planned to meet in Boston but, under existing conditions, it was thought best to choose a place as near as possible to the main centers of scientific activities. At the present time, large numbers of scientific men are working in Washington. Baltimore is, therefore, the logical place for the meeting. It is planned that the meeting will direct its main attention to the service of science in the present national emergency.

Summer Biological Stations.—The biological station of the University of Michigan, situated on the shores of Douglas Lake in the northern part of the southern peninsula of Michigan, is holding its tenth session this summer (July 1st-August 23d), under the direction of Prof. G. R. La Rue. The Lake Laboratory of the Ohio State University, formerly at Cedar Point, is located this summer at Put-in-Bay, South Bass Island, Lake Erie, and is directed by Dr. F. H. Krecker. The laboratory is quartered in the State fish hatchery. Courses are given in the various branches of aquatic and terrestrial biology, and accommodations are available for persons desiring to engage in research under the very favorable conditions of this locality.

Selenium Not in a Class by Itself.—According to recent experiments of the Bureau of Standards, an increase in electrical conductivity was observed in crystals of selenium, stibnite, boulangerite, jamesonite, bismuthinite, cylindrite, molybdenite and silver sulfide, when exposed to light. Radiophonic experiments are described in which some of these substances were joined through a battery to the grid circuit of an audion amplifier and a telephone. A change in current in this circuit affected the telephone. The light stimulus was interrupted by means of a rotating sectored disk. With several of the substances mentioned, sufficient change in conductivity occurred to cause a musical note or at least an audible vibration in the receiver. In the case of molybdenite it was found that the change in conductivity is to some extent a function of the thickness (heat capacity) of the lamina used.

Measuring Atmospheric Pollution.—The principal methods heretofore used in measuring atmospheric pollution were thus summarized by Dr. J. S. Owens, of the Coal Smoke Abatement society, at the 1913 meeting of the British Association for the Advancement of Science: (1) A measured volume of air may be filtered through some medium and the amount of the deposit ascertained by weighing; (2) in Aitken's dust-counter, the number of suspended particles is counted but no information is obtained as to their size; (3) a jet of air of standard size may be caused to strike a glass plate at a fixed distance from the nozzle and the capacity of the plate measured after a definite time (or white paper may be used and the discoloration measured); (4) the opacity of a column of air of given length to a standard light may be measured; (5) the visibility of objects at fixed distances may be noted and compared from time to time; (6) the impurities may be washed out of a known volume of air and subsequently collected for weighing and analysis. In the Third Report of the Committee for the Investigation of Atmospheric Pollution, recently issued in London, Dr. Owens describes a new process, which combines simplicity with a permanent record for reference purposes. A measured volume of air is filtered at a fixed rate through a disk of special paper of standard size, and the discoloration of the paper is compared with a prepared scale. The measurement takes ten minutes. By maintaining observations from day to day and from year to year, the fluctuations in the purity of the air at any place (with respect to solid impurities) can be accurately observed. Thus the success of efforts to abate the smoke nuisance can be tested, and comparisons can be made between the incidence of respiratory diseases and the amount of solid matter in the air.

Industrial Efficiency

Our Foreign Trade for 1918 has fallen off slightly in the fiscal year, the total being $8,874,000,000, compared with $8,949,000,000 in 1917. The imports for 1918 show an increase of $2,946,000,000. Exports, however, show a decrease of $362,000,000, the total for 1918 being $5,928,000,000, as compared with $6,290,000,000 in 1917. The excess of exports over imports amounted to $2,982,000,000 in 1918, against $3,631,000,000 in 1917.

A New Process of Hardening Leather.—A Norwegian engineer of the city of Arendal, Norway, claims to have succeeded after a series of experiments in inventing a method whereby sole leather can be hardened so that it attains two or three times its usual strength. The hardening may be done in several degrees, until the leather becomes stiff as wood. It is claimed that after suitable hardening, sufficient for common shoes or boots, it does not lose any of its elasticity. Another advantage claimed is that after this treatment the leather better resists moisture and heat. It is alleged that leather not otherwise suitable for anything but insoles may through this treatment become a satisfactory sole leather. The engineer is patenting his invention and sole leather treated after his method will soon be placed on the market in Norway.

How the Army Saves Sugar and Glycerine.—According to a recent announcement of the War Department, considerable savings in sugar and glycerine are being effected by the Quartermaster Corps in discontinuing the purchase of so-called glycerine soaps for the Army. Both of these products are used in the manufacture of soaps for the purpose of improving its appearance, but are unnecessary, as they do not add to the value except for commercial purposes. A recent order from a quartermaster called for 100,000 pounds of glycerine soap. Based on the usual formula, this soap would contain 15 per cent of sugar, or a total of 15,000 pounds, which would have been a complete waste. The soap was provided, but it did not contain sugar or glycerine, so that 15,000 pounds of sugar was saved for food and a proportionate amount of glycerine was saved for the manufacture of powerful explosives. The subsistence division of the Quartermaster Corps, through its inspection branch and the food-investigation section, is responsible for Army economies in the manufacture and supply of foodstuffs and for the saving of needed foods for the Army.

Walnut for Airplane Propellers and Gunstocks.—More American walnut is needed for airplane propellers and gunstocks. During the four years' test in the present war this wood has proved to be the best material for the manufacture of the foregoing articles. The Government needs all the walnut that can be secured during the continuance of the war, but it does not buy the wood direct, as not all of it can be used for the above purposes. Mills holding Government contracts for gunstocks or propellers are anxious to purchase walnut trees or logs, and the Government urges the owners of trees or logs to sell them to the sawmills. Owing to their inability to purchase sufficient walnut logs, the sawmill proprietors have not been able to supply the present requirements of this Government and the Allies. "Fight with your walnut trees" is the new slogan of the Hardwood Section, Bureau of Aircraft Production, and the Small Arms Section, Ordnance Department. Half a dozen trees will provide lumber for a propeller and supply gunstocks for a platoon of infantry. The lack of one plane in the air or a platoon in the front line might lose a battle. Every tree counts. Anyone having walnut trees 12 inches or more in diameter should write to Capt. R. L. Oakley, Production Division, Ordnance Department, Sixth and B Streets, Washington, D. C. He will advise correspondents as to where they can sell their walnut at a fair price.

Coal Saving in Pittsburgh.—Thomas R. Brown, administrative engineer of the United States Fuel Administration for the Pittsburgh district, in a report just received in Washington, says that through the inspection of industrial steam plants, which was begun there only a few weeks ago, a saving of 81,000 tons of coal per year has been effected in the Pittsburgh district. This saving represents a little more than one week of actual inspection under the general program recently announced by the Fuel Administration. In five manufacturing plants using coal for production of power an annual saving of 53,942 tons of coal have been made by improved methods of firing, stopping leaks around boiler settings, and other factors which make for economy in the general conditions of boiler plant operation. Mr. Brown's report discloses the startling fact that one great plant operated in his district was rated only 50 per cent efficient in the use of coal. If this ratio, or anything like it, should hold good for the industrial plants in other districts where the efficiency is recognized as not being nearly so high as in the Pittsburgh district, then the Fuel Administration feels that it will be an easy matter to save from 25,000,000 to 30,000,000 tons in the 250,000 industrial plants in the United States without in any way reducing the quality or quantity of the output.

At the Other End of the Phonograph

How Science and Humor Blend in the Work of the Phonographic Recording Laboratory

By Austin C. Lescarboura

ACCORDING to the textbook on physics, sound follows certain definite rules. An hour's reading should give the average man a good grounding in the subject. Yet the truth of the matter is that it requires more than any amount of reading to acquire a practical understanding of sound phenomena; for sound waves, it appears, have a way of playing numerous and inexplicable tricks at almost any time, upsetting the calculations of even experts. So it follows that any business which is based on the commercializing of sound must be an interesting one because of these uncertainties; and such indeed is the phonograph industry, wherein sound is captured or "canned," so to speak, and dispensed far and wide in the familiar form of records.

"Atmosphere" and the Recording Studio

In the very midst of the theatrical section of New York city is located the laboratory recently visited by the writer, for the purpose of studying a new process of making phonograph records. It was neither an office building nor a factory which bore the address he had set out to find; instead, it was an attractive four-story building with a white front trimmed with red-brick window-sills and arches and numerous window boxes filled to overflowing with flowers and vines. To all intents it was a residence of the better sort.

And the interior conveys the same impression to the visitor. For the reception room, which is reached directly from the street, is furnished with handsome rugs, tapestried furniture and floor-lamps, blending in a beautiful color scheme that is both pleasing and reassuring. There is nothing commercial about this reception room, which might as well serve as the living room of any well-to-do New Yorker. Then there are the private sitting rooms upstairs, furnished in the same artistic manner but provided with grand pianos, where artists can rehearse their selections before going to the laboratory proper.

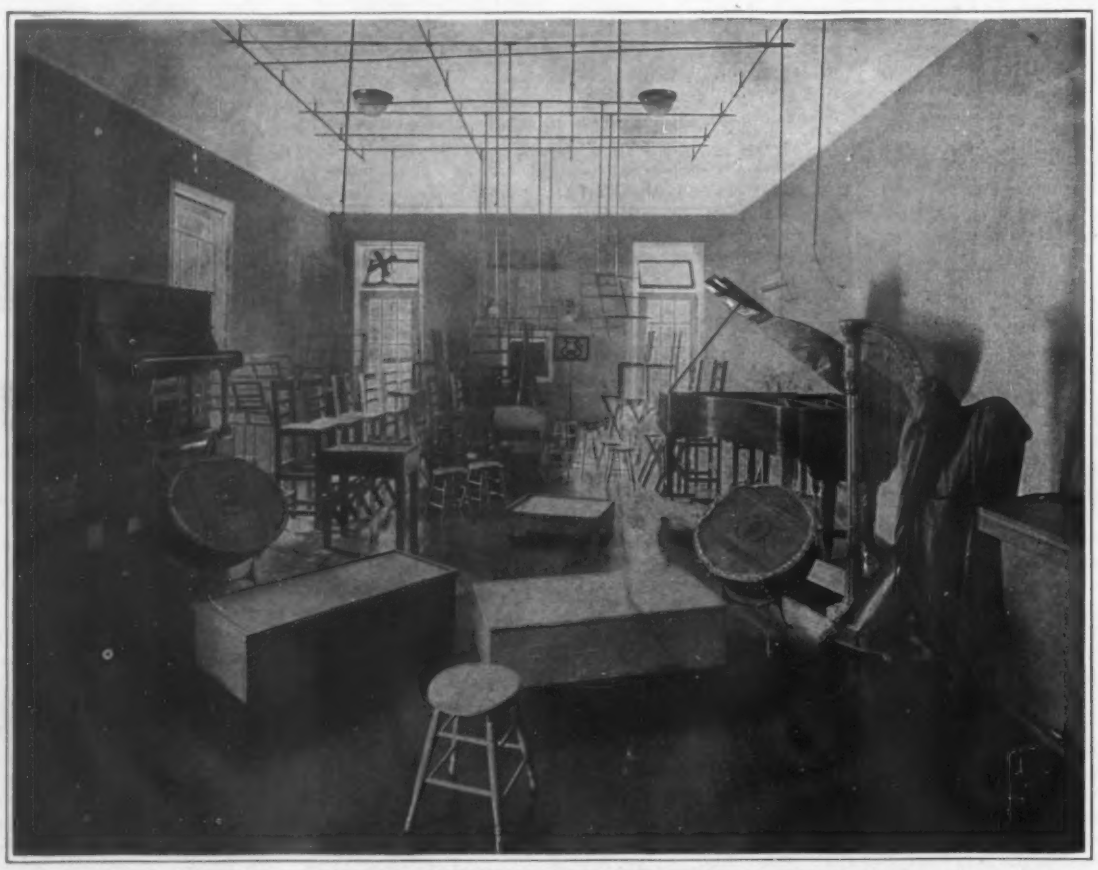
The reader must pardon the seeming digression from the main thread of the story. However, the excuse is a good one in this case. All of the description just given goes to convey some idea of the "atmosphere" of the studio and the high ideals of an organization which is perhaps the largest manufacturer of musical instruments in the world, and which only recently decided to enter into the manufacture of records in order to round out its phonograph enterprise. The organization had been producing a good phonograph; but, working on the theory that the phonograph and the record form an individual unit, it set to work producing records particularly suited to its machine.

Now this "atmosphere" matter appears to be an important one. There is such a thing as "phonograph fright," just as there is the well-known stage fright. Some artists can go right into the laboratory and make a perfect record from the very first; while others, equally famed and talented, go up before the little sound horn only to succumb to an attack of phonograph fright. This, no doubt, is due to the changed conditions; there are no footlights, no audience, and no applause. There is simply a little horn to stare at and to sing into. It is a brand new kind of work for the artist, who must learn to sing or play for the records. And that is where the "atmosphere" helps matters; for it removes much of the cold, mechanical aspect of recording. The artist comes to a "studio," not a factory; and in the seclusion of the home-like private sitting rooms he can rehearse his selections until he is ready for the laboratory on the floor above.

A long and wide room which has rounded corners only is the recording laboratory proper. At the farther end of this room is a partition with two doors, behind which is the delicate recording apparatus connected with the horn out front. All music is directed against this partition, in the center of which is the adjustable horn; and as in the motion-picture studio, there is an interesting collection of equipment about the room, ranging from chairs of all sizes and platforms of all heights to the bulkier of the musical instruments.

Presently the musicians, the singer, and the orchestra leader take their places facing the partition, for the purpose of recording a popular selection. The arrangement of the musicians proves to be a highly scientific one; in fact, the recording of each instrument being known through long experience, it is accordingly assigned to a place either nearer or farther away from the horn. The singer is directly in front of the horn and quite close to it, so that the voice will be predominant on the record. The orchestra leader stands on a platform to the side of the horn, in plain view of everyone.

The most bizarre feature of this laboratory scene is, no doubt, the seating arrangement. In order that each instrument will "focus" on the horn without interference of any sort, the musicians are seated on chairs of varying heights, with the lowest ones nearest the horn and the highest ones—six feet tall, in some cases—at the rear of the semi-circle. The music stands, in turn, are suspended from the ceiling, by an arrangement of overhead rails and hangers.



Note the characteristics of this room: Various sized chairs and platforms are on hand for the musicians and artists; the music-stands hang from the ceiling; all corners are rounded off instead of squared. The recording apparatus is behind the partition at the farther end, and is connected with the horn which in this view is not in the operating position.

Where the music of phonograph records comes from: A recording laboratory "between the acts"

Certain instruments, such as horns, must be kept in the background, while others, the violin for instance, are placed in the front row. In the case of brass instruments where the horn is behind the player, a queer situation arises. The sound must be directed toward the horn yet the musician must follow the orchestra leader. But these factors are apparently irrelevant. Fortunately, however, there are such things as mirrors; and with a large mirror mounted on an adjustable stand, the musician can sit with his back to the horn and the leader, while observing both through the mirror in front of him. Hence it is evident that appearances count little in the phonographic laboratory; sound and sound only is the vital thing.

The dress of the musicians also carries out the impression that appearances are secondary to results. Comfort being the first requisite to results, utmost comfort is therefore the rule. The musicians and the artist work in their shirt sleeves if they prefer, rather than in full dress and other decorum of the theatre and concert. The lady artists having no shirt sleeves to roll up and collars to remove, work in what amounts to as much, namely, in shirtwaist and skirt or other plain but comfortable clothes, instead of the evening gowns of the concert stage.

When everything is in readiness, the musicians wait for the buzzer signal which indicates that the recording apparatus has started and that every sound is being recorded. With the sound of the first buzzer signal, silence reigns.

A few seconds later a second buzzer signal indicates that the selection can begin, since the requisite number of blank grooves have been cut at the start of the record. It is these blank grooves which permit the turntable of the home phonograph to come to speed before the selection begins.

In the confined room of the recording laboratory the selection sounds quite loud. The leader carefully coaches the artist as well as the musicians. Finally, when the last note is reached, singer and musicians stop short without another sound until a voice from the other side of the partition announces the completion of the record. Because of the automatic stopping devices now so common on phonographs, several blank grooves must be cut at the end of the record as well as at the beginning, and these grooves must of course be silent.

One Hundred Per Cent Perfect

Should there be a discordant note during the recording of a selection, the wax record is irreparably ruined and work must start all over again. There is no such thing as patching in the recording process: the rendition must be absolutely correct before the record is considered usable. Once in a great while it so happens that a singer or a musician struggles unsuccessfully with a sneeze or cough that refuses to be downed. Right in the middle of a wonderful selection a sneeze or cough breaks out triumphantly! And no matter how much time may have been expended on the record up to that point, it is now wasted and work must begin all over again on a fresh wax disk.

What takes place during the recording of a selection can best be learned by entering the long and narrow room back of the partition, which, to be sure, is a great and rare privilege; for every phonograph company considers its recording apparatus as the very heart and brain of the organization. It is a true "holy of holies." And why shouldn't it be? Numerous secrets and years of experience and constant improvement are centered on the apparatus found in such little rooms as this one, or at the small end of the recording horn.

Now the sound waves entering the large end of the specially devised horn are brought down and intensified as they approach the smaller end. Here they strike upon a diaphragm which vibrates in response to their impulses. Connected with the center of this diaphragm by a delicate lever is a fine cutting tool. This tool, moving in response to the motion of the diaphragm, cuts a groove in a revolving disk of soft wax, which groove corresponds in configuration with the outline of the sound waves entering the horn.

The wax disk rests on a turntable operated by a gravity motor. Before each recording the weights of the gravity motor are raised to the ceiling of the room, so that there will be no danger of a stop during the subsequent run. Electric motor, spring motor, or any other form of drive is certain to fluctuate slightly in speed no matter what precautions may be taken; but gravity

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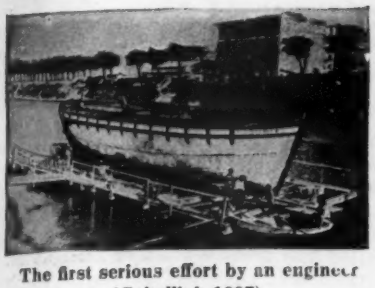
Ships of Stone—1849 to 1918

A Brief Resume of What Has Been Done in Maritime Concrete Construction



The first serious effort by an engineer (Gabellini, 1897)

UNTIL within a comparatively recent time, few persons had any knowledge as to the considerable use that has been made of concrete for boats, barges, ships and other floating construction. But the urgent cry for ships and more ships has compelled us to seek every means of supplementing the supply of older and better known shipbuilding materials. In this crisis attention has been directed to concrete; and developments have been so rapid during the past few months as to make it seem quite likely that concrete is to play a part little dreamed of in ocean transport.

It is interesting in this connection to look back and see to just what extent concrete has been employed in ship construction in the past. And when we do this we learn that reinforced concrete, in the present accepted sense of the term, was first used in boat building. In 1849 a concrete rowboat was built by M. Lambot, of Carces, France. The system employed was patented by the builder, who exhibited his work at the World's Fair held in Paris in 1855. It was said at the beginning of the Great War that his boat was still in service.

After this small beginning, it was 38 years before anybody was found to follow in Lambot's footsteps. In 1887 the brothers Picha-Stevens, of Sas van Gent, Holland, built the "Zeemeeuv," a rather large concrete vessel of row-boat type. This craft is reported to have encountered a number of severe collisions with larger vessels, and many times has been frozen in the ice all winter; yet it proved unusually stable and durable, and as recently as February, 1918, was still in use by a cement products plant of Amsterdam.

Next in the field was Carlo Gabellini, of Rome; and from 1897 to 1905 he had it all to himself, building various types of scows and barges and pontoons. His largest undertaking appears to have been a series of 150-ton barges. The first of these, constructed for the city of Civita Vecchia, underwent its very severe trials so successfully that a number of additional ones were ordered and manufactured.

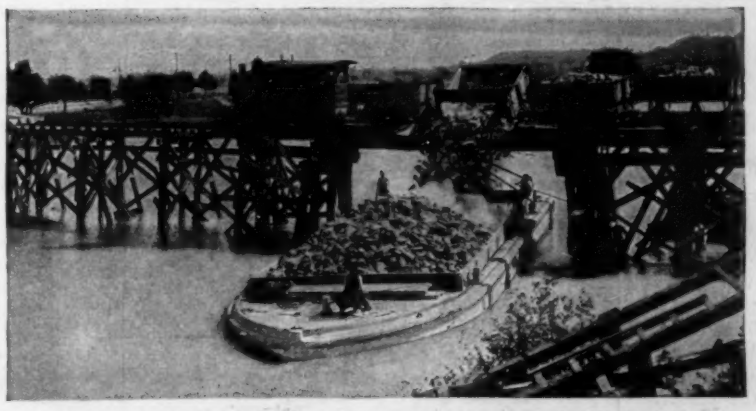
Following the precedents thus established in Holland and Italy, German builders in 1909 constructed, at Frankfort-am-Main, a concrete freighter of 200 tons for river service. Rectangular compartments formed watertight bulkheads in the structure, and a small after-cabin was added to complete the vessel.

In the same year an old wooden vessel which had become unseaworthy fell into the hands of A. A. Boon, of Amsterdam; and he used it as an inner form for the construction of his concrete ship "Juliana," with canal-boat lines. A netting was constructed of quarter-inch bars spaced to form meshes two inches square. This was assembled outside the old hull and covered with fine wire mesh; it was then filled in and over with concrete to a thickness of four inches. Following this, Boon in 1910 built a concrete barge of 50 tons capacity, the "Antoon," employing this time double walls after designs furnished him by Gabellini. In 1916, after six years of hard service, the "Antoon" was in excellent condition.

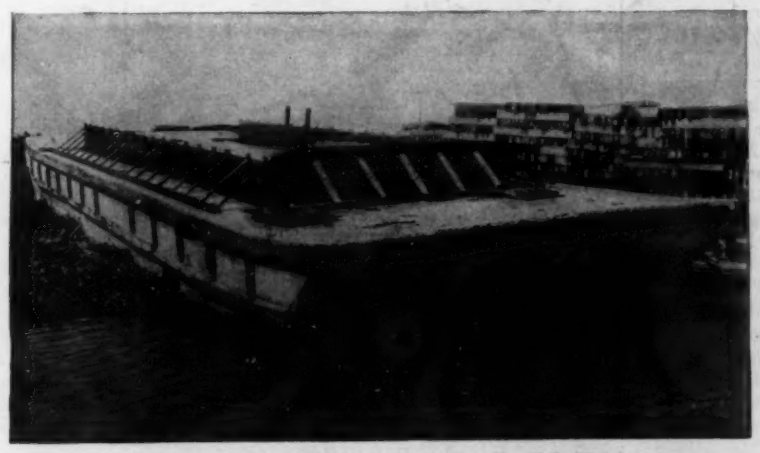
An example of concrete barge construction that has received more than its fair share of attention is the scow built in 1910 for use on the Welland Canal. This was rather mistakenly named the "Pioneer." It has been used chiefly to carry stone. At times whole carloads of this material have been dropped upon its deck from a twelve-foot trestle, without injury to the vessel. Its dimensions are eighty by twenty-four, with seven feet draft. It is still giving satisfactory service.

Another concrete lighter of the decked type, having a capacity of 60 tons, was built in Holland in 1910 and is still in use in Amsterdam. It is 68 by 15 feet, and divided into compartments by means of three longitudinal and 33 transverse partitions. In the following year was built the first of a class of open-top lighters now used extensively on the Dutch canals for the transport of ashes and other refuse. These vessels are 46 feet 8 inches by 10 feet, with a capacity of 15 tons.

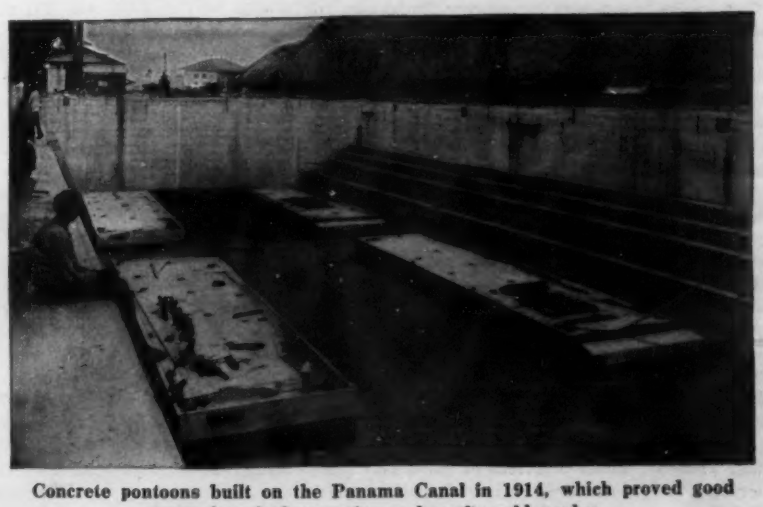
The first boat of stone, built at Carces, France, in 1849



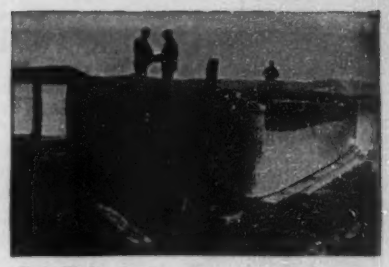
The "Pioneer," a concrete barge built in 1910 for use on the Welland Canal



A 90-foot barge built at Mobile in 1912 after the Gabellini system



Concrete pontoons built on the Panama Canal in 1914, which proved good examples of what service such craft could render



Gabellini's final model, a 150-ton barge (1905)

Of America's vast army of mechanically inclined recreation seekers who each spring go down to the nearest body of water and build themselves just the dandiest little boat that ever was to knock about in, W. N. Downsey, of Iron River, Mich, appears to have been the first to take serious stock in the idea of a stone boat. In 1911 he built him such a craft, and another in 1914. His second attempt at this interesting game has become something of a national character since he presented it, in October, 1917, to the United States Naval Reserves of Chicago. After being on exhibition in Washington and other places in the East, in June of the present year it started from Pittsburgh for a trip on its own keel via the Ohio, Mississippi and Illinois Rivers to Chicago, on a recruiting mission for the Navy.

In 1912 the largest concrete vessel yet attempted was put out in the form of a 500-ton scow built for a sand and gravel contracting concern of Baltimore. Several of its successors of the same general type have now been in use for four years or more in Chesapeake waters. The general manager of the operating company states that in all this time it has never been necessary to use a siphon to pump one of these craft out, an operation which is almost a daily event on a wooden lighter.

A novelty was the concrete sailboat launched in April, 1912, by Johannes Lescher of Dresden. Although subject to rough handling this ship was still giving excellent service when the war broke out in 1914.

In the building of a concrete barge at Mobile in 1912 the Gabellini method was employed. This barge is 90 by 26 feet, with nine feet depth. In 1916 she was washed ashore during a severe storm and in grounding struck an obstacle which punctured her side. She lay where she was until June 1918, when the growing interest in concrete ships led to her repair and restoration to service. This was effected in a very short time, and she is now in the oil transport service in the coastal waters of the Gulf.

Since about 1912 there have been in use, on various English canals, numerous large and small concrete barges. Perhaps the most important of these is one 100 feet long and of 28-foot beam, built for the Manchester Ship Canal in 1912. This vessel carries sludge pumps, boilers and fuel for use along the canal. Her cost was low and her maintenance is less than that of similar barges of other construction. Moreover, she can be repaired without docking, and hence without interruption of service.

Four concrete pontoons were built on the Panama Canal in 1914. They have received a good deal of publicity, and have proved what service such craft can render under adverse conditions. Four more of the same type were finished in 1916. These pontoons are used as landing stages for small steamers; and in this service they get a good many hard knocks, as any one can testify who has seen the Hudson River ferryboats at New York crash into their pile slips.

After investigating various possibilities, an Australian terminal company decided in 1914 to use concrete for a pontoon that was needed in the harbor of Sydney. This is 110 feet long, ranges in width

(Concluded on page 179)

Strategic Moves of the War, August 22d, 1918

By Our Military Expert

IN the last review closing on the 7th instant, the following was written: "It is possible that the Germans are expecting an attack on one or both sides of the Somme salient where weak flanks offer to the Allies some of the same advantages gained by the crushing blow on the Marne." Any strategical writer, familiar with the methods employed on both sides during the present war, would no doubt have drawn the same conclusion, especially as the Germans had begun already to draw back on the Ancre River north of the Somme and on the Avre to the south, evidently in fear of an attack of some kind and also for the purpose of assuring to themselves better defensive positions.

The possibility of just such an attack as was indicated in the quotation has become a glorious fact. On Thursday the 9th instant the Allied commander launched drives by the British on the north and by the French on the south that have wiped out the Montdidier salient and are leading to one of the greatest defeats that Germany has yet experienced. The German retreat on the Marne had scarcely had time to establish its lines on the Aisne and on the north bank of the Vesle when the blow again fell in the north. This was rendered possible by the superiority in numbers of the Allies and by the lack of readily available German reserves. The Allied armies in four days flattened the Montdidier salient and have no doubt driven from the mind of the German General Staff any idea of holding ground west of the old Hindenburg line that ran just west of Cambrai, St. Quentin, LaFére, Craonne and on to the north of Rheims.

It seems evident that the Germans are now offering the stoutest resistance in order to establish their lines and to restore their front somewhere between the Somme and the Oise along or near the lines indicated and from Péronne to the last mentioned river. They are first trying to hold the railroad and highway that run from Péronne east to Chaulnes to Roye; and, if driven from these, attempts will be made to hold the same roads running from Péronne to Nesle and Roye and thence turning southwest from Roye to Noyon. Behind these limits there would be a zone of safety; but, if the Allied drive is too strong, they would have to take refuge behind the old Hindenburg line where they previously stood for so long a time.

Here has been presented one of the best illustrations of the methods of warfare as developed in the present great struggle. There are generally four periods—the preparation for the advance, the attack, the pursuit and the approach to the enemy's new strong position. Two of these have already passed, the pursuit is in progress and the Allied drive is gradually slowing down as the Germans reach the high ground in their rear, especially on the eastern flank around Noyon. If the Allies can force the pivots on the south around Lassigny and if they can also force the ridge of high ground about Bapaume on the north, the Germans must at once fall back on the Hindenburg lines. As long as the Allied advance forms no narrow salient that can be squeezed by their opponents, there is little prospect that they will lose the fruits of their victory so far or that there will be any serious German counter offensive. The whole forward moves of the Allies recently have shown what can be done by strategy in the hands of such a master as Marshal Foch who is conducting the offensive with such consummate skill and confidence.

The cessation in a degree of the fighting on the north, but continued between the Somme and the Oise, allows a consideration of the operations and aims of the Allies since the thrust began. Their strategy had in view evidently the breaking of the sides of the Montidider salient so that neither troops nor supplies could be brought up to support the German forces in the western apex. The immediate effect of the original British attack on the north from Alobert to the main road leading from Amiens to St. Quentin was to break the German lines on a front of ten or twelve miles through which break their troops poured, making an extreme advance on the first day of nine or ten miles as a maximum. Further south the French attacked from the British right to and beyond Montdidier. There was no great artillery preparation beforehand, everything being based upon the element of surprise.

That it was a surprise to the Germans was shown by the ease with which their lines were penetrated, by the number of men made prisoners, and by the quantity of material captured. For three days the British advance was not held in check and points at least fifteen miles in advance of their original bases were reached. On the south the French experienced heavier resistance but finally Montidier was flanked from the east and north and the Germans were turned out of the extreme western points of their lines. Still further south another French army began an offensive between Montdidier and the Oise and pushed north and east in the direction of Noyon and the rail and highway center of Roye. In five days after the attack began, the Germans were practically back on their old Somme front that was occupied prior to the famous Hindenburg strategic retreat, their lines running almost in a straight line from Albert to Ribécourt through or near Chaulnes; the latter has repeatedly changed hands since the moves began. Since that time the principal operations have been in the direction of Roye, Lassigny, and Noyon, all three being threatened with capture at any time.

In fact, at the present writing, it seems to be but a question of hours when Roye must be given up as it is in a pocket and apparently can not be held. The same remark applies to Lassigny, where the French are said already to hold the outskirts. All the operations here are linking up with the general purpose of the French commander to break the present German lines with their strongest hold at Chaulnes, Roye, Lassigny, and Noyon. It seems clear that the Germans cannot hold much longer the line of Bray-Chaulnes-Roye-Lassigny; this can no longer be defended except at a price too costly to be considered. All German counter attacks on the lines have been repulsed without difficulty. The capture just reported of the position of Autreches to the northwest of Soissons indicates that the Allies will soon have broken the junction points of the Aisne and the Somme-Oise fronts. The move from the south and east of the Montdidier salient has for some time reached

Allied advances in Picardy and Flanders

its final stages, where the Germans are desperately resisting to do their best in a very bad situation. The salient itself is gone and just now they seem at a loss where to dig in for a permanent stand.

The original Allied advance here had two objects—one was to uncover Amiens, which was under German shell fire, and then to open up once more the rail communications from Paris through Amiens to the north; the other object was to open up the theatre of operations so that more room could be obtained for maneuvers. Just now, the threat, both to Paris and to the railroads from it north, has been removed; the avenue of approach to the city by way of the Oise valley has been shut just as has been the case on the Marne. The Germans have no longer any hopes of breaking the junction of the British and French lines of defense or of interfering with the lines of French communication between Paris, Amiens, Abbeville and Calais. While all the ground gained by the Germans in their March advance has not been recovered, all the serious consequences of both the spring and summer advances have been removed. The French commander has definitely taken the offensive from the German leader.

The whole face of the campaign has been changed by strategical master strokes. So far 40,000 prisoners, many hundreds of guns, and quantities of war supplies have been captured and a general advance of ten or fifteen miles on a 35-mile front has been made. It seems quite clear what the Germans must do in the near future. Already north of Albert towards Arras the positions of Beaumont-Hamel, Puisieux and Bucqnoy, all of which were gained after hard fighting and much bloodshed, have been given up. While the Germans are holding tenaciously to the high grounds south of Lassigny and between that place and Noyon and also to the similar ground about Bapaume in the north, there is every reason to believe that all this effort is only temporary. They may hold for a time their old front of two years ago; but everything points to the belief that they must go back finally to the Hindenburg line from which they started in March last. This would take with it the question of holding the Vesle lines on the Aisne front; for, if it is necessary to withdraw to the Hindenburg line, then there must be a general withdrawal all the way from Arras to Rheims which would carry the Vesle lines to the north behind the Aisne or to the Chemin des Dames. In the Lys salient on the north between Ypres and Bethune, the Germans are gradually withdrawing. The British troops have made an advance of six miles and so far have found a thinly defended German line. The Germans have removed their heavy guns and material out of the threatened area and are waiting only for the proper time to retreat.

The Germans will then have to acknowledge that all the gains of the spring and summer campaigns have been lost and that they have experienced the worst defeats of the war—defeats following a well organized Allied offensive. In view of the losses in men, guns and material and of the consequent effects upon the German troops and nation, the retreat might not end at the Hindenburg lines; but there may be reason to hope that, before next winter begins, they may be thrown back beyond the French frontier. This is especially probable if our own troops can be got to the front in such numbers as to give the commander-in-chief all necessary forces for a continuous forward thrust with reserves at all times at hand. The Allied road to Berlin may seem at present a long one; but the German road to Paris is constantly lengthening out, due largely to our own help, which is at last making up for the effects of the Russian collapse; and many things can happen between now and the beginning of December next.

Complete victory cannot be gained in one battle; there will be a number of these, each a move in the great strategical war game that is being played on the western front. And for the Germans, the worst is the game of attrition that is gradually destroying them. The least calculation makes their losses since March last a million men, of whom 150,000 have been killed outright and 70,000 or more made prisoners. In March last with a superiority of forces a great success was gained and this was continued in April, May, and June. But in the middle of July the tide turned; and, since that time, one repulse has followed another with such losses that the numerical superiority has become an inferiority with no prospect of any change for the better during the continuance of the war.

A few days ago a surprise to the world was given by the announcement that a British force was taking part in the defence of the port of Baku and of the oil district on the western shore of the Caspian Sea; as the notice was official, it shows that the English have performed a most brilliant and daring feat and have made for the Allies a gain that will have in the end most far-reaching results. At Baku a number of Armenians and Bolsheviki (Russians) had undertaken the defense against the Turks and Tartars. The latter, although under Russian rule, are closely akin to the Turks in religion and race and have taken sides with them in the present hostilities.

It is evident that some time ago the commander of the British forces at Bagdad detached a force for the purpose of aiding in the defence of the port. The secret of the detachment of such a force as well as any knowledge of its composition and strength, was completely guarded as nothing appears to have been known concerning it. The troops followed the old caravan route through Kurdistan and Persia via Khanikin, Kermanshah and Hamadan to Resht and the port of Enzeli on the Caspian where boats were taken to Baku. Apparently little opposition was offered by the local authorities in the mountains; but the expedition had to pass through a most difficult country. Motor transport was no doubt impracticable and the question of supplies must have been a serious one. To effect the taking of Baku, the British troops marched 700 miles in the mountains of Kurdistan and Persia; it is evident that only the friendly coöperation of the Persian officials could have made this possible. Certainly, the British commander in Mesopotamia must have felt his position most secure when he could forward a column of troops of sufficient strength to such a distance and on such a mission.

The capture of Baku will furnish to the Armenians,

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Eyes in the Finger Tips

THE comfortable belief has long been held that the individual unfortunate enough to be deprived of one or more of his senses was in some measure compensated by a gratifying stimulation of the others. Records of the doubly afflicted blind deafmutes, Marie Heurtin of France and Laura Bridgman and Helen Keller of this country, seem to bear out the theory, all of them exhibiting an extraordinary degree of tactile sensitiveness. Thus Miss Bridgman, according to tests made by the aesthesiometer, an instrument for measuring delicacy of tactile perception, exhibited twice as much sensitiveness at the tip of the tongue as the normal person, nearly three times as much at the end of the index finger and on the lips, and more than three times as much on cheek and forehead. And we have known a blind man who ran up and down stairs, in and out of rooms and corridors, with amazing speed and precision, and who actually traveled alone on the New York subway twice daily without mishap, solely through his ability to detect the presence of a wall several yards away by sensing the slight compression of the air between the obstruction and his face.

On the other hand extensive experiments in institutions have shown quite opposite results. Griesbach found by use of the aesthesiometer that his blind subjects were slightly less sensitive than seeing persons of the same age. Moreover the tests with Zwaardemaker's olfactometer showed them to have a less keen olfactory sense than normal individuals. It is true that Griesbach found his subjects slightly more accurate in the location of sound, but another authority, Dufour, had contrary results from his experiments. In general, the conclusion of Griesbach and other recent experimenters is to the effect that the infirmity of one sense does not involve a vicarious keenness on the part of the others—the "law of organic equivalence" as formulated by Geoffroy Saint Hilaire—but is in fact more often accompanied by a feebleness of the others.

How shall we reconcile these discrepancies of opinion among the learned? A recent writer on the subject, Dr. Ioteyko, formerly head of the Psycho-Physiological Laboratory at the University of Brussels, and more recently a lecturer at the College de Paris offers an ingenious and convincing explanation.

Writing in the *Revue Scientifique* (Paris) this authority observes that this apparent parodox may be readily resolved if we remember that the evidence of the senses is two-fold. Seeing a bright spot is a merely physiologic sensation, but perceiving that this bright spot is a definite object with certain shapes and colors and possessing certain properties is psychologic, an interpretation made by the aid of the intelligence. While it may well be impossible by exercise to increase the keenness of the mere sensation, it is quite possible to improve the psychologic interpretation of its significance. In this way improved perception becomes a sort of gain; the brain develops a species of detective skill by means of which it is able to draw, from the sense impressions which it receives, inferences and conclusions not formerly possible.

Dr. Ioteyko sustains this theory with many interesting examples drawn from the study of children born blind and later gaining vision through operation. Such children have to be taught to see; the visual sense impressions mean nothing to them except as subsequent experience attaches meaning. They must learn by repeated experiment and long practice to correlate and coördinate the new sensations with previous ones gained by other senses. Thus an orange will be regarded with indifference as a mere splotch of yellow till the connection between this sensation of yellow color and round form is made with the previous knowledge gained by touch, smell and taste. And such correlation and coördination of ideas depends infinitely less on acuity of sensation than on the degree of intelligence supplemented by careful and patient teaching. The deliberate conclusion of Dr. A. Chavanis, a Lyons oculist who made an extended study of the case of a boy of eight, of lively intelligence, both of whose eyes were operated on, is that the restoration of sight is rather more the affair of the teacher, indeed, than of the operator. This case was uncommonly interesting; the child had great difficulty in grasping outline and remembering objects by their shapes, but quickly learned to perceive and distinguish colors, and was then taught gradually to associate shapes with colors and tactile memories.

Mlle. Ioteyko points out that Marie Heurtin, Laura Bridgman and Helen Keller, though suffering under exceptional sensorial privation, were all gifted with admirable intelligence and were all fortunate enough to have the most careful and painstaking teaching, whereas the inmates of institutions, such as those examined by Griesbach and others, are only too apt to be of inferior intelligence and to have lacked skilled and devoted instruction.

These studies are the more interesting because of the large number of men who have been blinded in the trenches on the western front in the Great War. Mlle. Ioteyko observes that these men present a parallel, but inverse, case to those born blind who must be taught to see. The blinded soldier must be taught to touch. Having depended largely on visual perceptions all his life he has had insufficient practice of tactile perception. It is now the touch and the muscular sense which are charged with replacing the lacking vision. An apprenticeship in touching things according to scientific rules is therefore, absolutely required to enable the mutilated man to attain perfection in handicraft. He must perform with minute care appropriate exercises to establish perfect concordance between things once seen and now merely touched. He must observe and classify differences of tactile sensation formerly ignored, and in every way educate his brain to draw inferences from these sensations. Success in this will depend on the intelligence and the will power of the individual plus the instruction he receives, since this vicarious power is purely psychologic.

Fighting Insects with Insects

THE romantic idea of utilizing one species of insect to fight another for the purpose of protecting plants from the ravages of the latter dates back to the eighties of the last century, when the orchards and gardens of California were suffering damage to the extent of millions of dollars a year from the depredations of a tiny insect known as the fluted scale. Orange and lemon trees were the greatest sufferers. The scale insect was a native of Australia, but it was not known as a pest in that country. This was due, as experts from the United States Department of Agriculture discovered, to the fact that Australia also possessed a certain beetle—a species of ladybird—which lived exclusively on a diet of fluted scales. Several hundred Australian ladybirds were shipped to California, where they were liberated upon orange trees. The result was little short of miraculous. The ladybirds increased at an enormous rate—it is said that one of them, in five months, becomes the ancestress of 75 billion—and in less than five years hardly a fluted scale was to be found in California. Indeed, in any given locality the work of extermination took only a few weeks.

The experiment of thus pitting the active and prolific *Novius cardinalis* against the nearly immobile *Icerya purchasi* has since been repeated in other regions, with generally successful results. In 1892 *Novius* was introduced into Hawaii; in 1898 into Portugal; in 1901 into Italy; in 1907 into Syria; and in 1912 into southern France. In 1893 it scored a triumph over another species of *Icerya* (*I. aegyptiaca*) in Egypt. Thus a once dreaded insect pest has been rendered harmless over the greater part of its range.

Naturally the popular imagination was inflamed by these successes, and some erroneous and harmful ideas were spread abroad. "Many enthusiasts," says Dr. L. O. Howard, "concluded that it was no longer necessary to use insecticidal mixtures and that all that was necessary in order to eradicate any insect pest of horticulture or of agriculture was to send to Australia for its natural enemy. In fact, it is safe to say that, by blinding people to other and immediate measures of control, this success retarded the general warfare against injurious insects."

An example of the mischief done by popular misconceptions on this subject is furnished by the experience of the orange growers of Florida, where the long scale and the purple scale were serious pests. Because *Novius cardinalis* had triumphed over the fluted scale in California it was assumed that it would prove destructive to other scales. Specimens were accordingly imported from California and liberated in the Florida groves. Unfortunately a supply of the fluted scale was sent in the same shipment to furnish food to the beneficent beetles *en route*. The net result of the experiment was that the specimens of *Novius* died, and the fluted scale became established in Florida, where it had previously been unknown.

Since the pioneer experiments above described, the practice of using parasitic or predaceous insects to control insect pests has become a well established feature of scientific agriculture and horticulture, and it now occupies the attention of many entomologists. A few marked successes have been scored, but there have been many more disappointments. The sugar-cane leafhopper of Hawaii has been kept well in check by parasites introduced from Australia. The sugar-cane weevilborer of the same islands has been almost as fully controled by a parasite from New Guinea. A scale insect which preys on mulberry trees, and which threatened for a time to ruin the silk industry of Italy, has been nearly driven out of Italy by a minute parasite, *Prospaltella berlesei*, brought from America and Japan.

At the present time special interest attaches, on this side of the ocean, to the efforts that are being made to find effective insect enemies for the gipsy and brown-tail moths, which have played such havoc with the orchards and woods of New England. Though the problem has not yet been fully solved, much progress has been made. More than thirty different species of parasites have been introduced in this campaign, and many of these have become acclimatized and are spreading rapidly in the infested area. It is estimated that more than 18,000,000 individual parasites have thus been colonized, and that, in some localities, they are destroying about fifty per cent of the injurious moths. Though entomologists predict that both the gipsy and the brown-tail will gradually spread westward, it is believed that their newly introduced enemies will spread with them, so that they will never become the serious pests elsewhere that they have been in New England.

The philosophy of this practice is better understood than it was a few years ago, and it is now easy to see why so many experiments have failed. Parasites, taken out of their natural habitat, may become a prey to "hyperparasites," and these, in turn, to tertiary parasites. A transplanted species may not be able to endure the climate of its new environment. The fact that an insect is destructive to agriculture in one region but not in another does not mean, necessarily, that it is held in check in the latter region by the insects found to be parasitic or predaceous upon it. Its harmlessness may be due to various other natural causes.

The subject is extremely complex, and its literature seems to be rather scant. We would commend to the attention of those who are interested, an article on "Entomophagous Insects and their Practical Employment in Agriculture," by Prof. Antonio Berlese, published last year by the International Institute of Agriculture; also an article by Dr. L. O. Howard in the current Yearbook of the U. S. Department of Agriculture.

Armor-Plated Seed Fertilized by Electricity

IN the latitude of Chicago it is estimated that the precipitation of nitrogen to the earth in the form of nitric acid by the natural electric disturbances in the atmosphere amounted to ten to eleven pounds of nitrogen per acre per year. In the tropics where thunderstorms are more frequent and static conditions augmented, a larger amount is precipitated, and vegetation is therefore, as we know, more abundant. Accordingly, we may expect that if we discharge electricity through the soil and through the air and moisture in the soil, we not only will stimulate the bacteria of life to greater activity known to occur after natural electrical discharges, but will give them their principal plant food by producing nitric acid and nitrogen.

In coöperation with the Engineering Department of a large electric company in Chicago, there has been in the past year successfully tested a newly patented process embodying this principle. High-frequency current is literally driven in a spray through the surface of the soil from special distributing electrodes embedded in the earth (about six inches deep), arranged parallel to each other on two opposite sides of the field along the fence lines, out of the way of cultivation. The seeds, before planting, are coated with a finely divided, non-deteriorating metal, with the object of creating lines of low resistance and a condition analogous to the coherer of a wireless set. Tests were made on eleven acres of corn and a few rows of sugar beets at Lobard, Ill. The increase in the corn production is estimated at thirty to forty per cent, with an increase in the value of the crop estimated at $25 to $35 per acre. It is claimed that the cost for current and metallic coating of the seed is less than fifty cents per acre, and the net cost of the apparatus installed less than $200.

Simple Sugar Extraction from Beet

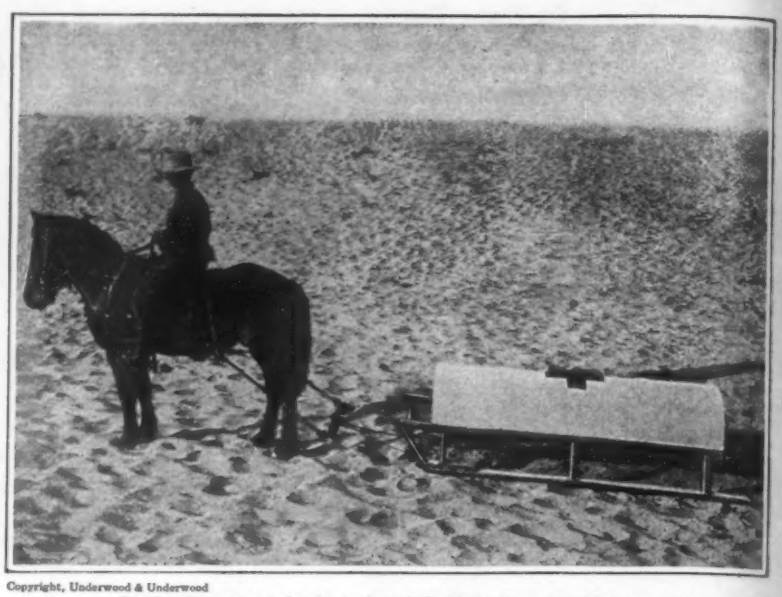
SOME recent experiments have shown that the extraction of intensely sweet syrup from sugar beet suitable for any kind of household use is quite easy. The plan can be carried out on a very small scale and, when generally known, is sure to be widely adopted. Sugar beets as a garden crop is more largely grown than formerly and there should be plenty of roots this season.

The best roots should be lifted in the usual way, care being taken that they are not injured. It is most needful to avoid breaking the skin. The roots should be treated in small quantities as the sweet stuff is required. This is because the syrup will not keep in good condition for more than a month or so. The method is to wash the roots well in water so as to get all the dirt away. Take care again not to break the skin in any part, or much of the sweetness will be lost in the next stage. Place the roots in a pan and boil them in water until the skin can be easily peeled away. Then slice the roots thinly and put the pieces into the pan again. Just cover them with water. Bring to the boil once, and allow the whole to simmer slowly for about ten hours. This treatment may be spread over two days if it is more convenient.

At the end of this simmering take the pulp and put it into a muslin bag. Then hold over a bowl and with the hands squeeze out all the juice you can. This juice is placed in a pan and boiled until it becomes thick and syrupy. The syrup will be very sweet indeed and of great value for all ordinary purposes.

As has been indicated this syrup will not keep for an indefinite period but it's easy to make it as required for use. The beets can be stored away in a dry, frost free place and taken out as needed.

One stretcher case can be handled by the little dog-drawn ambulances used on the French front



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In the deserts of the Holy Land the British are making use of this queer sand sled

Odd Ways of Transporting Wounded Soldiers

How the Methods Vary According to the Terrain of the Battlefields

IN a long drawn out war such as we are now engaged in, the proper handling of wounded soldiers is quite as important as other military matters, such as the supplying of fresh drafts from time to time. For with both sides leaving no effort undone to maintain at the front as large a force as is possible, every wounded soldier is a possible new soldier if cared for in time and brought back to full strength. Indeed, we have been told repeatedly by the Germans that 80 per cent of their wounded are returned to the front in due course; and while we do not have to believe that statement, seeing whence it comes, the fact remains that all belligerents are returning many wounded men to the ranks in the course of a short time.

The first essential in caring for wounded men is proper transportation to first-aid stations and later to base hospitals. Under the adverse conditions encountered on different battlefields, it is obvious that this transportation often takes on queer forms. It seems that no end of vehicles have been tried since the war began for just this purpose.

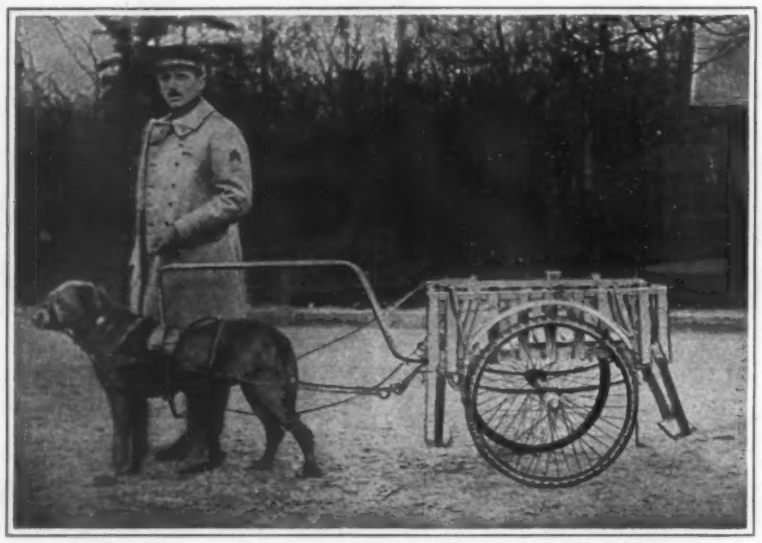
In the Balkans the British hospital men make use of the double-deck litter shown in one of the accompanying illustrations. This litter is slung between two donkeys; and because of the mountainous terrain about Saloniki, this vehicle is said to be ideal.

Down in the Holy Land, on desert battlefields, new methods of handling the wounded must needs be found. The British have had fair success with the sand sled of the type illustrated in another view, which is drawn by horse, mule or camel. A canvas cover is provided to protect the wounded from the hot rays of the sun.

The hand-carried stretcher and the stretcher mounted on a pair of wheels are perhaps the more common of the numerous and diversified transportation methods for the wounded on the battlefields of France. Extensive experiments have been carried out by the French with a so-called *avion sanitaire* or airplane ambulance, capable of carrying wounded soldiers in absolute safety and comfort, and in the minimum of time for long journeys. The airplane ambulance, no doubt, represents the most ambitious scheme yet tried on any battlefield.

More recently the dog-drawn ambulance has appeared on the Western front. This little two-wheeled vehicle, which is shown in two of the accompanying illustrations, is arranged for carrying two "sitting up" cases or one stretcher case. Attention is drawn to the peculiar, but nevertheless ingenious, shaft arrangement which terminates in a pad resting on the dog's back, and which serves to maintain the vehicle in a level position with the use of but one pair of wheels, as illustrated.

The dog-drawn vehicle has another use and one that is of equal importance to the transportation of the wounded. It is widely employed by officers as a means of rapid travel between posts along the front, in which case the occupant sits at the front end and drives the dog by means of conventional reins. If desired, a passenger can be carried at the rear, although this materially reduces the speed of travel. No doubt the idea of dog-drawn ambulances originated with the Belgians.



The "sitting-up" cases can be transported in this little dog-drawn ambulance over the roughest terrain

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Down in the Balkans the British make use of a double-deck stretcher swung between two mules

The Current Supplement

THE science and practice of flying has evolved so rapidly during the last few years that it has been difficult, even for those who are devoting their entire attention to the subject, to keep in touch with all its multitudinous branches, so the paper on *Modern Aeronautics*, of which the first part appears in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2226, for August 31st, and which reviews very comprehensively the many features of the flying machine, and indicates a number of outstanding problems, will be quite generally acceptable. The wonderful displays of Northern Lights have astonished, delighted and mystified hosts of people, and many theories as to their cause and nature have been put forward. In an article in the current issue on *The Aurora* the possibility of explaining it by means of a corpuscular ray theory is considered; and the paper is illustrated by a number of photographs and diagrams. The paper on *The Psychology of Color* is concluded in this issue. *National Economy in England* illustrates by a number of excellent photographs how various kinds of war material, rescued at the front and sent home, are sorted for distribution to the factories where they can be renovated for further use. *Substitutes for Wheat* describes the very thorough investigation of flours from various grains that have been made in France to find something from which bread can be made to increase the supplies of the armies. The information contained in this article will be of great value in this country also. *The Use of Soap Films* describes and illustrates an ingenious method of solving various problems of torsion in metals. *Contact Insecticides* considers the physical properties governing the efficiency of various materials for killing insects that infest vegetation, and their eggs. Other articles in this issue include *The Ornithopter*, *Position-Light Signals for Railroad Service*, *How Can Soft Coal Be Burned Without Smoke in Marine Boilers?* and *Factors Influencing the Spread of Parasites.*

Extracting Argon from the Air

THE atmosphere contains a tolerably large percentage of argon. It has heretofore been found difficult to extract it industrially in a sufficiently pure state to be used in incandescent lamps except at too great a cost. This is because it occupies an intermediate place between oxygen and nitrogen with regard to liquefaction, so that when the attempt is made to isolate it by fractional compression or distillation, it always passes over accompanied by the two former gases. This problem has now been solved, however, by M. George Claude in the following manner: He makes use of an apparatus in which he eliminates the nitrogen of the atmosphere by means of liquid air. The residue consists of a liquid composed of oxygen and argon from which the argon is easily extracted by burning the mixture with the required proportion of hydrogen. In this way, by the most careful analysis, Mr. Claude has found it easy thus to obtain gaseous mixtures containing 75 to 80 per cent of argon, and only one or two per cent of nitrogen, together with the oxygen.

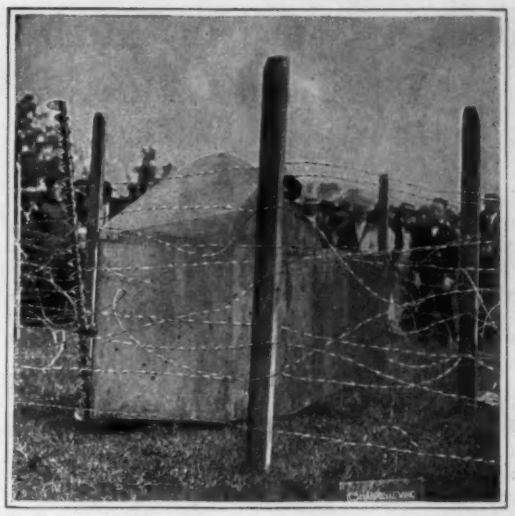
Overcoming Barbed Wire with the Wire-Cutting Tank

EVEN the casual reader of war news must by now understand that the two greatest obstacles in the way of any offensive are the barbed-wire belts and the machine guns of the defenders. To attempt an attack while the barbed wire out front is still intact is to solicit suicide; for the attacking forces, held up by the stout belts of prickly strands, become an easy target for enemy machine gunners. So in any offensive the cutting of the barbed wires is a necessary preliminary. That is why the inventive talent of every belligerent nation has been turned in good measure on the problem of destroying barbed-wire entanglements.

A recent American suggestion is the wire-cutting tank, which, as will be noted in the accompanying illustration, is really more in the nature of large body armor. However, the armor in this case is mounted on wheels and is propelled by the crew consisting of two men. One man propels the machine by good old foot power while the other operates a lever which cuts the strands of barbed wire after they have become engaged with the cutting mechanism at the prow of this small landship.

The armor plate of this diminutive tank is of sufficient thickness to resist rifle and machine-gun fire, while its size affords much protection against artillery fire. In a recent test at Washington this device went through several rows of barbed-wire entanglements in short order.

It would seem that the new wire-cutting tank can be employed in place of large tanks in preparing the way for a trench or surprise raid, just as the armies at present make use of heavy armor for protecting the wire cutters.



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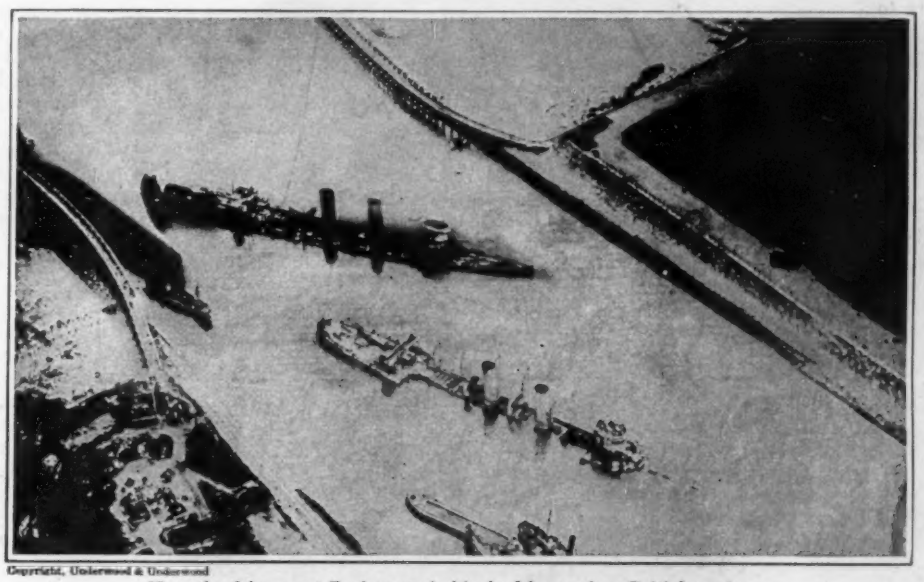
An American wire-cutting tank making its way through a typical barbed-wire belt

German Photograph of British Ships Sunk at Zeebrugge

INCLUDED in a wonderful exhibition of large colored photographs, which is being held under the auspices of the Ministry of Information, to illustrate the work of the British navy, is a most interesting photograph, which was captured from a German airman. As will be seen from our reproduction, the photograph was evidently taken at a low altitude and it shows with much detail the two British protected cruisers, which were sunk on the night of the great raid near to the entrance to the Bruges Canal at Zeebrugge. The tide was very low at the time, and this explains why so large a portion of the vessels' hulls can be seen above water. Evidently the entrance was not entirely blocked, probably for the reason that it was impossible to give the ships sufficient helm to swing them entirely broadside to the axis of the channel. The degree to which the entrance is blocked depends largely upon the character of the bottom at the bow and stern of these vessels. In any case, there must be a tendency to serious silting, and dredging operations must be greatly hindered, if not indeed altogether prevented, by the attacks of Allied airmen.



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How the fairway at Zeebrugge is blocked by sunken British cruisers

The Biggest Gun Ever Built

HERE we have a photograph of one of the shells of the largest and most powerful gun ever built—probably the largest that ever will be built. The diameter of the shell is 52 centimeters, or 20 ¼ inches. The gun so greatly exceeds the German 42-centimeter gun, as to be in a class by itself; for not only is the French gun much greater in size and weight, but it is a high-velocity, long-range gun, whereas the German piece is a relatively low-velocity howitzer of comparatively limited range.

The German 42-centimeter gun was designed primarily for reducing the Belgian fortifications; but also it had a decided moral effect. The French in getting out this huge weapon also had a double object in view. It is encouraging to the French troops to know that their artillery includes a gun which is immeasurably more powerful and destructive than the heaviest guns of the enemy; and, conversely, it is depressing to the German troops to know that their own artillery is greatly outmatched, particularly when they are eye-witnesses of the appalling destruction wrought by a single hit with one of these shells.

Referring to the photograph, it will be seen that the shell must be at least six feet, and possibly six and a half feet in length. It has the characteristic finely-tempered head of the French shells, and also there is the usual slight tapering of the after portion. The weight has been given as 3,200 pounds. If this be so, it is just 1,000 pounds heavier than the shell of our new 50-caliber, 16-inch naval gun which weighs 2,200 pounds. Necessarily, the gun itself must be exceedingly heavy. Our 16-inch, 35-caliber rifle, now at Panama, weighs 284,000 pounds; and since this French piece is probably 30 calibers, and may even be 45 calibers in length, its weight must be somewhere around 400,000 pounds. Of course, a gun of this weight has to stick to the railways, and it has necessitated the designing of a special carriage of great strength to carry the enormous load and stand the heavy stresses of the recoil.

What the gun can do was shown in the attack on the Chemin des Dames, when a single shell, planted squarely within Malmaison fort, caused such havoc as to put the fort entirely out of commission. The French built two of these guns some two years ago, and it is probable that a few more have been constructed in the interim. They are so very costly, however, that it is not likely that a large number will be built.

They will be ideal guns for the reduction of the powerful rings of forts surrounding Metz; and when the Allies are ready for their great drive up the Rhine valley, they will probably play an important part in the reduction of that city.

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One of the huge shells that the French are hurling into the German lines

How Finicky Inspectors Hold Up War Work

AN interesting account of the effect of finicky inspectors of steel and iron on the retardation of airplane work is afforded by the following case, which is typical of many others in these days of rush where many of the inspectors employed are often ill-suited to the important work or are incompetent.

Federal inspectors rejected several hundred pounds of common bolts for airplanes because they weighed 6 ounces more to the hundredweight than the specifications called for, and also a large quantity that did not come within the thousandth part of an inch of the set measurement, none of which varied from it by as much as the hundredth part of an inch. It is possible to make such parts with greater exactness than this bolt factory did, but it would more than double the cost and also consume the time of two or three times as many men who would have to be employed in finishing them by hand. To be accurate within the thousandth part of an inch the machinist would have to stop the machine after every cut, caliper the product with a micrometer and adjust the tool and make a test cut, which would also have to be calipered. A manufacturer might as well scrap his automatic machines as use them in that way; an old-fashioned lathe would do more work under such conditions.

Take the lot of bolts that weighed 6 ounces more than the specified hundredweight. That represents a departure of about one-third of one per cent from the standard. Before those bolts passed through the various hands and became part of a finished airplane they would lose that 6 ounces and more by attrition. In the case of the nuts, they would lose more than the thousandth part of an inch in being screwed on with a wrench, and what wrench would find the differences of a thousandth or a hundredth part of an inch? Inspection should be rigid but intelligent; and rejection should not follow a departure from set standards which is not of practical importance.

Prisoner's Dropsy

DR. F. S. PARKS, of Toronto, has been a prisoner in a German camp at Minden, where he practiced for 18 months among his thousands of comrades. Many of these men suffered from war edema or dropsy, the most prevalent malady in that camp. At first Russians and Rumanians were the chief victims; but later the Italians suffered most. The French prisoners at reprisal camps and the English who were kept working on lines of communication also suffered greatly.

The German rations, along with hard work, exposure and depressing environment, were responsible for this dropsy, which prevailed most in the spring and early summer of 1917, when those rations were most insufficient. That dietary was very low in protein (tissue building food), and was practically fat-free. It consisted almost entirely of soup; so that much fluid had to be taken to obtain a small amount of nourishment. This extra load of fluid was too great to be eliminated by the feeble heart and the overworked kidneys; hence, the dropsy, the anasarca.

This war edema or *Kriegsoedem* begins with slight puffiness of the feet and legs, which disappears on lying down; to be that way was not enough for a hospital admission. The latter was not forthcoming until there was massive edema, the whole of the lower extremities and the eyelids puffed, with not infrequently dropsical abdomens and chests. With all this there was general weakness and pain, especially in the shin bones. The sufferer then became pallid, his muscles wasted, his heart weak and slow-beating. In uncomplicated cases improvement came with rations, containing meats and fats. Bronchitis was common and those who died had bronchopneumonia and water on the lungs.

The Heavens in September, 1918

Professor Fowler Forces a Revision of Our Ideas of Solar Temperatures

By Prof. Henry Norris Russell, Ph.D.

THE increasing diversion of the activities of scientific men, along with those of all other good citizens, into channels directly connected with the war, is beginning to have its inevitable result in the diminution of the volume of scientific work published in American periodicals. This is neither surprising nor, under present conditions, regrettable. It is rather a matter for surprise and congratulation that so much good scientific work continues to be done, not merely here, but in the countries which entered the war at the start, and have borne a far heavier burden.

Another Runaway Star

Purely astronomical information—perhaps on account of its obvious remoteness from the war—is one of the very few things that seems still able to get across the great barrier; and in this way the news has been permitted to pass that Dr. Max Wolf, of Heidelberg, has recently discovered, by comparison of photographs, a very faint star of remarkably rapid proper motion. The object is of the thirteenth magnitude, on the photographs at least, and its proper motion is nearly five seconds of arc per year—which is exceeded only by about half a dozen known stars.

The interest of this tiny object lies in its probable nearness, and its corresponding faintness. It would be dangerous to attempt anything more than a rough guess at its distance, for we have no other information about such very faint stars to guide us. From such data as we have, however, it seems likely that the distance will turn out to be something like ten or twenty light-years. If so, the star must be one of the least luminous objects known, and may even turn out to be fainter than Barnard's star, which is of about 1/2500 the sun's brightness, though it is doubtful that it will come out fainter than Innes' companion to Alpha Centauri, which is less than 1/10,000 as bright as the sun. Parallax observers will doubtless put the star on their lists at once, and within a year or two we will know the facts.

Of more general interest is an announcement that comes from London, in two short papers by Professor Fowler of South Kensington—one of the most successful of living spectroscopists—who has made important new discoveries in that well worked field, the solar spectrum. It might have been supposed that this best known of all spectra, which has been photographed and measured with extreme care for the past generation, had been "worked out"; but this is evidently far from the case. The stronger lines were almost all identified years ago, mainly through the classic work of Rowland, who detected the presence of thirty-six of the familiar terrestrial chemical elements in the sun's atmosphere; but a multitude of weak lines remained unindentified.

Spectrum Lines and What They Mean

In some cases these weaker lines were grouped more or less conspicuously into bands in definite regions of the spectrum. Now it appears to be a general rule that the incandescent vapors of the chemical elements—or, to be more precise, vapors composed of separate atoms—give spectra consisting of isolated lines; while the incandescent vapors of chemical compounds, or indeed any vapors in which the luminous centers are molecules, consisting of atoms that are combined with one another, give spectra consisting of bands, which themselves are made up of closely packed fine lines.

The first of such bands to be recognized in the solar spectrum was the conspicuous one in the extreme violet, which shows up so strongly in the spectrum of an ordinary arc in air. This band, and some others related to it, were long supposed to be produced by some compound of carbon and nitrogen, since the presence of both elements was necessary for their appearance; and they were called the "cyanogen bands." Some work of Runge's, done just before the war, makes it very probable that they originate from nitrogen alone, but presumably from luminous nitrogen molecules, not split up, or dissociated, into their component atoms.

Some years after the first recognition of the so-called cyanogen bands, the bands which appear prominently in the spectra of sun-spots were identified as arising from metallic compounds—titanium oxide, and the hydrides of calcium and magnesium. The first mentioned of these bands do not appear in the spectrum of the photosphere, showing that the temperature outside of the spots is high enough to decompose the titanium oxide vapor into its elements; but the others do show, though faintly, on the ordinary solar spectrum, indicating that the temperature is not high enough to decompose the corresponding compounds completely.

More recently—indeed, since the war began—Newall and his associates at Cambridge showed that the strong band in the violet of the solar spectrum (Fraunhofer's G-band) was due to hydrocarbon vapors in the solar atmosphere. The proof was altogether conclusive, more than fifty lines in the hydrocarbon spectra cited for comparison agreeing exactly with solar lines. Now comes Fowler's work, which shows, from a study of the ultra-violet region, that the solar atmosphere also contains the undissociated vapors of two of the most familiar of chemical compounds—ammonia and water.

Water and Ammonia on the Sun

The evidence is of exactly the same nature as in the earlier cases. An electric arc in an atmosphere of ammonia gives a strong set of bands near λ3,300; and more than fifty of the lines composing these bands are present, with considerable strength, in the solar spectrum, where they form a band which is conspicuous under low dispersion. The water-vapor lines, which appear in the spectrum of the oxy-hydrogen flame, are of still shorter wave-length, and just accessible to astronomical observation, lying close to the limit where absorption by the ozone in our upper atmosphere cuts off all shorter light waves. But here again the coincidence of the solar and terrestrial lines, both in position and in relative intensity, is complete, and the proof accordingly unquestionable.

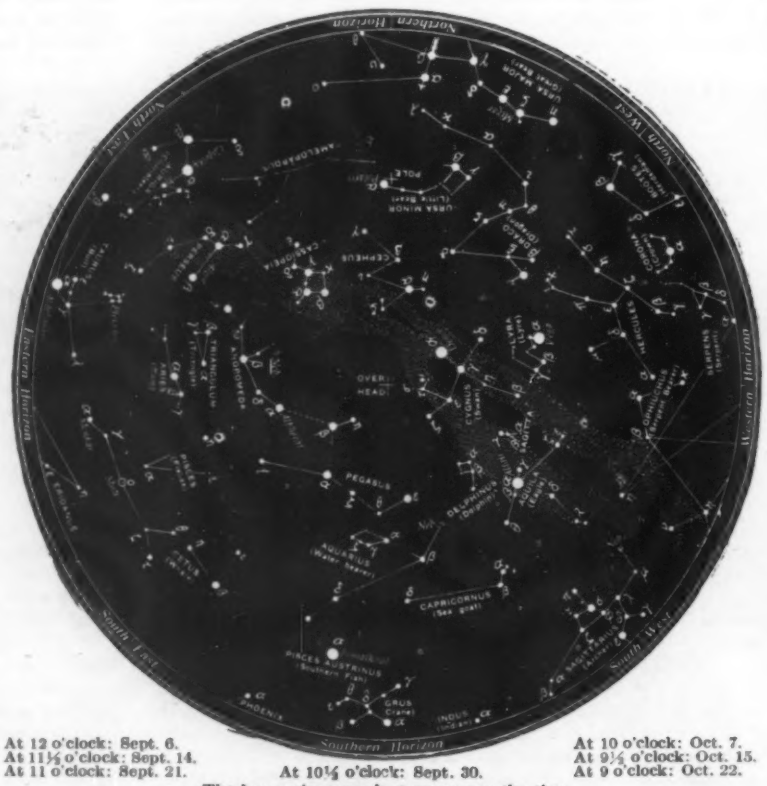
It appears therefore that the old idea that the sun's surface was so hot that all chemical compounds were decomposed into their elements, is incorrect. Many, probably most, compounds are so decomposed; and even the most refractory ones are probably broken up to some extent. But among those which survive the ordeal, at least in part, are some of the most familiar of common substances—hydrocarbons, ammonia and water. The detection of the latter, at this late day, in what is literally, as well as metaphorically, the most conspicuous place in the universe as we see it from the earth, is a feat upon which Professor Fowler may well be congratulated, and a fine piece of evidence that British science has by no means been extinguished by four years' strenuous national participation in the Great War.

The Heavens

As our map shows, the dull constellations of autumn are occupying more and more of the southern sky. The great square of Pegasus, high up in the southeast, is conspicuous. Far below its western edge, across a wide and almost empty space, is the isolated bright star Formalhaut, in the Southern Fish. Still lower, and conspicuous only to southern observers, is the fairly bright constellation of the Crane.

Far to the left, and very much alone, is a second isolated bright star, Beta Ceti. This belongs to a huge constellation containing several stars of the third magnitude, which, however, are scattered so widely as to make but a feeble show.

Aries is well up in the east, with the Pleiades below. Auriga is low in the northeast, Perseus next above, then Cassiopeia and Cepheus, the last nearly overhead. Following on along the milky way we reach Cygnus and Lyra, then Aquila—where the great Nova of June is still visible to the naked eye but inconspicuous—and finally Sagittarius, low in the southwest. Hercules and Corona are low in the west and northwest, Draco and Ursa Minor well up in the north, and Ursa Major, below them, close to the horizon.



At 12 o'clock: Sept. 6.
At 11½ o'clock: Sept. 14.
At 11 o'clock: Sept. 21.
At 10½ o'clock: Sept. 30.
At 10 o'clock: Oct. 7.
At 9½ o'clock: Oct. 15.
At 9 o'clock: Oct. 22.

The hours given are in summer months time

NIGHT SKY: SEPTEMBER AND OCTOBER

The Planets

Mercury is in conjunction with the sun on the 1st, and is a morning star after this date. He is best visible about the 18th, when he is farthest from the sun, and rises at 5.15 A. M., clock time. Though in perihelion and only 18° from the sun, he is very bright, and should easily be seen.

Venus is also a morning star, and very near Mercury; indeed, the two planets are in conjunction on the 14th, at a distance of 1°20′, and again on the 25th, at a distance of only twenty minutes of arc. Venus is also in conjunction with Saturn on the 5th, the two planets only 5′ apart when closest, but unfortunately invisible in our longitude at that time.

Mars is an evening star in Libra, setting at 9.20 by the clock in the middle of the month.

Jupiter is a morning star in Gemini, rising about 1 A. M. in the middle of the month.

Saturn is a morning star in Leo, and rises at 5 A. M. on the 1st and at 3.20 on the 30th. Uranus is in Capricornus and well observable all the evening. On August 30th he is in R. A. 21h. 51m. 23s., declination 13°49′15′′, and is seven minutes north and 35 minutes west of the fifth magnitude star Mu Capricorni; while on September 18th he is due south of this star, at a distance of six minutes, so that it will be easy to find him with a field glass.

Neptune is in Cancer, and rises about 3 A. M.

The moon is new at 7 A. M. on the 5th, in her first quarter at 11 A. M. on the 13th, full at 9 A. M. on the 20th, and in her last quarter at 1 A. M. on the 27th. She is nearest us on the 21st, and farthest away on the 8th. As she traverses her track, she comes into conjunction with Neptune on the 2nd, Mercury on the 4th, Mars on the 10th, Uranus on the 18th, Jupiter on the 27th, and Neptune again on the 29th.

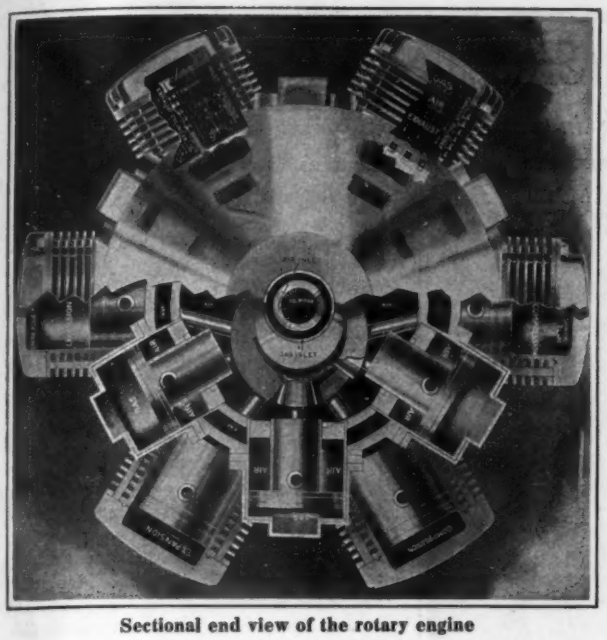
At 4.46 P. M. on September 23rd, by our present clock time, the sun crosses the celestial equator and "autumn commences."

Washington, D. C., August 12.

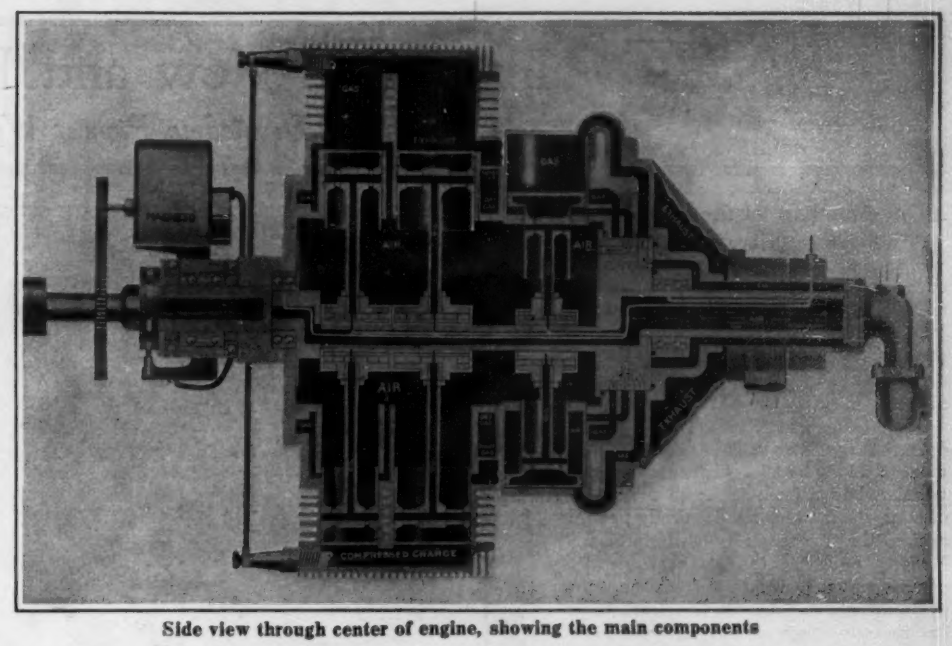
Oil from Bones

THE business of extracting oils and fats from bones has had an extraordinary expansion of late all over Germany. Great numbers of private and of municipal plants are thus engaged, according to the *Leipziger Volkszeitung*, and have reaped enormous profits. While the use of the autoclave process has been increasingly extended, a more recent process in which an important part is played by benzine now threatens to oust the former, since it permits of a more complete recovery of the fats, though the final product is less agreeable in taste.

The Scheidemantel group which uses the benzine extraction processes is said to have distributed 300 per cent of dividends. It now looks to a monopoly of this industry in Germany and is strongly supported by the War Committee on Fats and Oils, which has decided to close, at a certain date, the 80 autoclave plants. The proprietors of the latter are making vigorous efforts naturally to have this order rescinded.



Sectional end view of the rotary engine



Side view through center of engine, showing the main components

A Two-Cycle Super-Induction Gas Engine for the Automobile

DURING a recent test an automobile equipped with a rotary gasoline engine now developed to the commercial stage, was driven from Buffalo, N. Y., to Toronto, Ontario, a distance of 137 miles, on less than one quart of oil and with an average fuel consumption better than 20 miles to the gallon. In a word, that tells what are the possibilities of the new engine.

The inventor of the rotary automobile engine used in the above-mentioned test is Benjamin F. Augustine of Buffalo, N. Y., whose automatic rotary engine operating on steam was described in these columns several years ago.

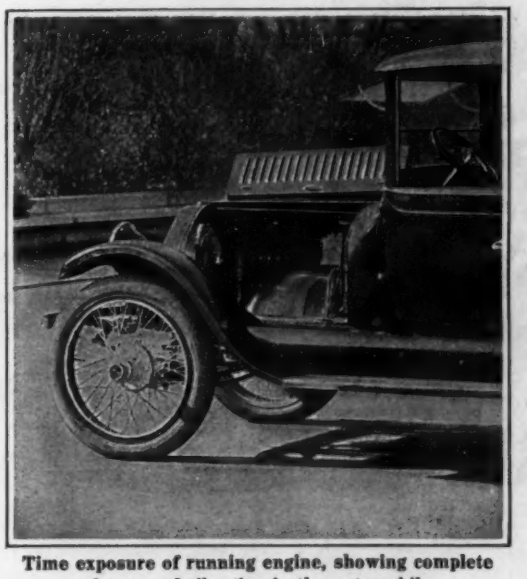
The new rotary engine, which is illustrated in the accompanying photograph and drawings, is claimed to be 100 per cent scavenging, whereas the majority of internal combustion engines in common use cannot get better scavenging than 30 per cent; and with the remainder of smoke left in the cylinders the incoming gas combines with the smoke and causes a great waste of fuel, not to mention the creation of carbon which soon causes trouble and has to be removed. The Augustine engine runs at high speed, is mounted on a two-point suspension, and since there is no reversal of the piston, there is no vibration, as is evident from the photograph showing the engine installed in an automobile. This photograph, which is a time exposure, shows the engine running while the car itself is absolutely sharp, indicating the complete absence of vibration. The engine can be built within two pounds per horse-power, which means that it is well suited to airplane work.

The rotary engine is equipped with a magneto and also an electric starter. It has a simple mixer to supply the fuel. It air-cools itself while in action; and as it rotates the bearings, shaft and oil are kept cool by the incoming charge. The fuel is transferred to the inner chamber where the moist fuel is carried by centrifugal force to the inner walls of the pistons and vaporized to dry gas, being pre-heated before it is admitted to the cylinders. As the engine rotates the exhaust ports open first followed immediately by the inlet ports which allow the dry gas under pressure to drive all burnt gases out of the cylinder through the exhaust ports, this "uniflow" action preventing cycloning and effecting a 100 per cent scavenge, according to Mr. Augustine.

There can be no waste of fuel since the exhaust ports are closed at a fixed time before the inlet ports, and the charge is regulated by the throttle. The large area of the fuel pumps supplies the "super-induction" charge for each revolution.

The new engine is started by turning on the switch of the magneto, pressing the button of the self-starter, and the cylinders get into motion. To stop the engine, the switch is turned off and all the cylinders charge themselves with fresh fuel from the inner chamber and are ready for the next run. The engine can be started with a coil and battery if desired. The engine is made reversible by simply adding a sleeve to reverse the inlet and transfer ports, thereby making it reversible like an ordinary steam engine.

Easy operation is claimed for this prime mover. It is practically fool-proof for the reason that there are no adjustments to be made; the ignition is in regular sequence as the cylinders successively pass the ignition point; there is only one commutator wire, from the magneto to the brush; the firing order of the cylinders is 1, 2, 3, 4, 5, and 6 in revolution, giving a perfectly constant torque. By the perfect control of the oil supply and the complete scavenging the formation of carbon in the cylinders, as already stated, is prevented, placing this engine in a class by itself. Indeed, this engine operates with a steady torque that is quite suggestive of the electric motor, at all speeds. This is all the more noticeable when the engine is installed in a car and is throttled down to two miles per hour; for then, with the slightest touch of the throttle, the engine responds and the car moves along at a high rate of speed without the slightest jar or vibration.



Time exposure of running engine, showing complete absence of vibration in the automobile

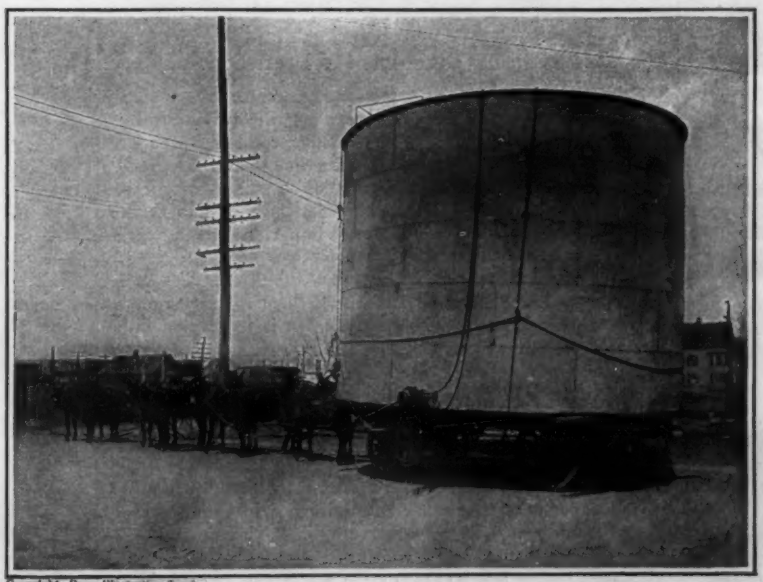
The fuel gas is drawn from the carburetor by pumping devices and delivered to the crank casings where it is put under slight compression. The degree of compression is controlled by the throttle condition of the carburetor. The fuel gas passes directly from the crank casings to the cylinders, entering through intake ports at the inner ends of the cylinders, and the burnt gases are expelled through large exhaust ports at the outer ends of the cylinders. These exhaust ports are controlled by a sleeve which is positively moved, and the sleeve is timed to close the exhaust ports prior to the closing of the intake ports. This effects super-induction of the fuel gases. It is well known that all airplane motors up to this time obtain only about thirty-five per cent efficiency at high altitudes, and this is due largely to the small volume of fuel gas taken into the cylinders by reason of the low atmospheric pressure. By the super-induction brought about in the Augustine engine through the closing of the exhaust ports and the large pumping capacity which can deliver a large volume of gas to the cylinders, a very high volumetric efficiency is obtained even at these high altitudes.

Another feature which has to be contended with in the rotary type of engine is the centrifugal force which becomes an enormous factor in a high speed engine. One piston has been balanced against another, but in the present engines the expansion force of the gases against the outer end of the piston is not only constantly working against centrifugal force but throws the centrifugal force on the opposed pistons out of balance. The new engine, on the other hand, entirely overcomes those difficulties and this is accomplished by arranging the expansion and compression chamber for the fuel gases so that the expanding gases work against the inner face of the piston, forcing the same outward and pulling on the fixed crank to turn the engine rather than thrusting against the crank. The expanding force of the gas against the piston operates in the same direction as the centrifugal force and is added thereto and does not in any way destroy the balance of one piston against the other.

Another essential feature in an airplane engine is extreme light weight. In the Augustine engine each cylinder is divided by the piston into a pumping chamber and an expansion and compression chamber for the fuel gases. The gases are pumped by the same piston which is acted upon by the expanding gases and therefore the piston is double acting. By using the one cylinder both for pumping the gases and for the expansion of the gases in turning the engine, the engine may be made very light.

Furthermore, where the expansion of the gases is against the inner end of the cylinder and the crank casing, while the outer end of the cylinder is only subjected to the suction and the discharge of the gases, the cylinder may be made extremely light. In other words, the force of the expanding gases is practically taken up by the piston head and the crank casing itself. The sleeve which controls the exhaust ports is also timed to cover the exhaust ports when the outer end of the cylinder operates

(*Concluded on page 179*)



Eight mules drawing a gas tank through the streets of Lynn, Mass.

Moving a Gas Tank on a Mule-Drawn Truck

THE city of Lynn, Mass., was recently treated to the rather novel spectacle of a gas tank hauled through the streets by eight mules. As will be noted in the accompanying illustration, the gas tank was placed on a substantial truck and hauled along by its mule power. The journey was about a mile in length; and its successful consummation was largely due to the delicate balancing of the bulky load.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

A One-Man Saw for the Lumber Jack

AT a time when labor is becoming more scarce every minute, labor-saving devices must necessarily have a wide appeal. So the moment seems appropriate to direct attention to the accompanying illustration of an ingeniously-designed one-man saw, which is capable of felling fair-sized trees.

The one-man saw, it will be noted, is operated by the back-and-forth movement of a long handle. This movement is translated to a back-and-forth movement of a large saw which is kept firmly pressed against the tree trunk by spring pressure. Various adjustments are available for controlling the length of stroke, the pressure, and so on. In brief, the saw has the advantage of being a great labor saver, and at the same time weighing little and costing little so that it comes well within the reach of all. Its weight is such that one can readily carry it about.

By rocking the handle back and forth, one man can cut down a large tree by means of this saw

Novel Auto Reel

By Frank C. Perkins

THE accompanying illustration shows a unique auto reel developed at Liberty, Mo. This reel will wind one mile of wire in 10 minutes, it is claimed; and old wire can be replaced by new and the old wire wound in one operation, mechanically and a hundred times faster than was ever before possible.

In order to replace old wire with new it is only necessary to untie the old wire, leaving it to lay on the cross arms, and to splice one end of the old wire to a pay-out reel of new wire. With the loose end attached to the auto-reel, mechanically and in operation the old wire is reeled up and replaced by new wire. This feature alone saves days of labor whenever replacing old wires. The auto reel is surprisingly simple in its construction and is made of angle and channel steel which makes it light and very strong. It requires no motor or machinery to operate except an automobile (of any make). It is really three reels in one as it can be converted into a hand reel in less than two minutes without the use of tools and by a simple operation can be transformed into a pay-out reel.

As a power take-up reel it is attached to the rear wheel of any automobile and will not scratch or mar the wheel and can be attached in three minutes without any tools. The car is "jacked up" so that the reel clears the ground several inches and a block is put under the other rear wheel so that the machine will not move. The wire to be reeled is passed through the guide, which is on the running board directly below the driver's seat, and fastened to the auto reel.

After starting the motor it should be kept in first or second speed. The guide is operated by the driver so that the wire is evenly distributed over the reel. This guide is a very important feature as it is so constructed that the splicing in the wire passes through it without the holder losing its grip on the wire. It insures tight, smoothly wound wire. Over one-half mile of wire can be wound in less than ten minutes into one smooth and solid bale in this manner and can be removed from the reel by pulling out the rod that is held near the top by a spring. It is not necessary to remove the reel. By attaching a handle it can be changed into a hand reel in two minutes. When used as a pay-out reel the specially designed spring tension prevents the wire from paying out too readily.

The wire winds or unwinds as the car proceeds

Measuring Garments to a Precise Fit

TWO reasons why some persons prefer to have their garments made to order are, first, the privilege of selecting a certain piece of cloth, and second, the securing of a finished garment that fits the wearer to perfection. Obviously, the fitting of a made-to-order garment calls for great care in the fitting; and to this end the work of the fitter is a most important one in any tailoring establishment.

With a view of making the work of the fitter still more accurate, Barthel Agnes of Chicago, Ill., has devised an ingenious measuring instrument which is illustrated in two of the accompanying illustrations. Instead of the conventional tape measure, which must needs give only approximate measurements in the hands of the average fitter, the new device gives precise measurements for all sizes ranging from 34 to 52 inches. It has two levels to insure exactness. The tapes are held accurately in line with the measuring points, from which are taken all the important measurements on either right or left side of the body, such as strap measure, blade measure, over-shoulder measure, breast width and sleeve length.

By placing Mr. Agnes' device under the arm of the person being fitted, a definite point is secured for one end of the tape measure, as contrasted to the usual method of holding it at a more or less variable point with the hand. Another part of this measuring device is the collar-hook tape measure, which, as its name implies, hooks over the middle of the linen collar and automatically gives the measurements for the collar of the garment.

Using a recently-invented device for taking the measurements for a garment

Glazing Without Metal

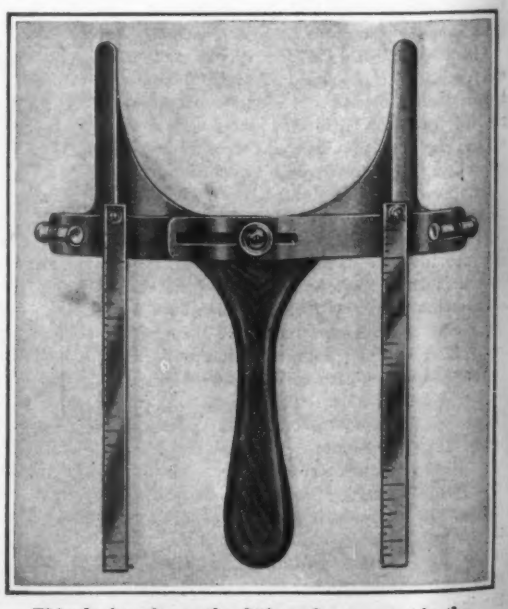
IN the already known art glazing processes the small individual panes of glass are bordered or "framed" with lead and then all of them are joined together to form the colored glass window or other decoration. Since the advent of the war, however, the use of metals of all kinds has been more and more restricted in Germany, so that it has been necessary to find some suitable substitute for this purpose.

According to a new process the single pieces of glass are arranged in the manner desired upon a fireproof backing and are then joined all together by heating in the kiln with the aid of a good glass flux. As soon as this first fusion has been effected the entire piece of work, together with the backing, is withdrawn from the kiln, finely powdered glass flux is filled into all crevices and joints and it is then melted by the assistance of a blowpipe. The piece of work is now ready for mounting in position, and absolutely no leading or metal bordering of any kind is required. The artistic effect is enhanced by the method of mounting and the picture is not so much "broken up" as by the pieces of metal.

Vanadium and the Long Range German Guns

AN analysis of fragments of the shells fired at Paris by the German long-range guns has shown that the walls of the projectiles contain a considerable proportion of vanadium, and speculation has been aroused as to the source from which Germany obtains this metal. Some vanadium is produced in Sweden, but it was thought that any importations from that country were consumed in the manufacture of steel for submarines. It is estimated that the Peruvian mines supplied more than three-quarters of the metal which reached the world's markets before the war, and none of this is known to have reached Germany by direct shipment since the commencement of the rigid blockade.

American steelmakers think that when preparing for the war Germany laid in large stocks of vanadium. The point which interests them particularly is the ability of the German shellmakers to make use of the alloy for a special purpose after nearly four years of war. Either the accumulated stock was much greater than was believed in 1914, or imports by secret channels have kept the supply abreast of the heavy demand. When the submarine "Deutschland" left New York on her second trip home it was rumored that a large consignment of vanadium was aboard, and that in both trips the undersea cargo-carrier took back 25,000 pounds of the metal.



This device places the fitting of a garment in the class of precision work

RECENTLY PATENTED INVENTIONS

Pertaining to Apparel

TROUSERS.—I. L. MORRIS, 205 Main St., White Plains, N. Y. The object of the invention is to provide trousers adapted to be comfortably worn without the use of suspenders or a belt. In order to accomplish the desired result use is made of a trousers body having a front provided with flies and having a back of unbroken continuity, the front and back having side portions, which overlie forming side slits, terminating in back straps connected with each other exteriorly at the back of the trousers, a fastening device detachably connecting the ends with each other.

DRESS FASTENER.—J. R. FULLER, Station E, Kansas City, Mo. This invention relates to separable metal buttons and fasteners for dresses and clothes. The principal object of the in-

PLAN VIEWS OF THE BASE, DISK AND CONNECTER DEVICE

vention is to provide a separable fastener comprising two relatively flat cooperating members adapted to be stitched or otherwise permanently secured to relatively movable parts of the garment, the flat members being adapted to be detachably connected through a combined sliding and rotating movement with respect to each other.

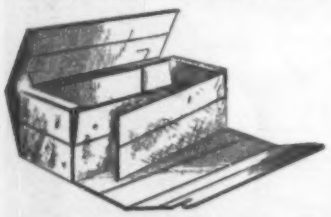
Electrical Devices

TELEPHONE TIMER AND SWITCH.—A. A. WELLS, 42 High St., E. Detroit, Mich. The object of the invention is to provide a telephone timer and switch which will limit the use of a telephone by a subscriber. The timer will operate the switch to cut out the transmitter and receiver after a predetermined period of use. It may also be adjusted to prevent the subscriber from again making use of the telephone for a predetermined period thereby permitting the other subscribers on a party line to make use of the telephone.

SEARCH LIGHT HOLDER.—E. C. REYNOLDS, 663 Amsterdam Ave., New York, N. Y. An object of the invention is to provide a holding means adapted to be instantly applied to the arm of the user and to readily receive the flashlight in a manner to permit the latter to be turned through any desired angle relatively to the arm on which the light is supported. A further object is to provide means to nest the device in compact form for convenient carrying in a pocket or tool box, when not in use.

Of General Interest

PAPER CURRENCY WRAPPER.—T. P. MARTIN, Jr., Oklahoma, Okla. The present invention relates to an improvement upon patent No. 1,162,501 which was granted to the same inventor November 30th, 1915. The chief object being the production of a much stronger



PERSPECTIVE VIEW OF THE WRAPPER PARTLY FOLDED

and more durable wrapper that may be folded to provide receptacles of different capacities of which the larger would be of substantially twice the cubical capacity of the smaller to contain larger and smaller packages of currency, Government notes and national bank bills.

PENCIL SHARPENER.—C. A. CANOVER, 53 Water St., Newburgh, N. Y. The invention relates to a pencil sharpener which may be readily applied or removed from any ordinary pencil now on the market. A further object is to provide a sharpener having a securing means at one end and a cutting means at the other, formed with a body or casing in two parts and one or more cutting blades held in place in such manner as to cut substantially in a spiral when in use.

COMPOSITION OF MATTER FOR CLEANING.—E. C. BILTON, care of American Marble Cleaning Co., 158 E. 36th St., New York, N. Y. The object of the invention is to provide a composition of matter to be used for cleaning, enlivening and preserving marble, onyx, granite, porcelain, tiling, enamel ware, ivory, cut glass and other materials and articles, and arranged for application to the article as a coating by means of a damp pad or the like to take up the dirt and extraneous matter by absorption. The composition consists of borax soap, salsoda, borax, ammonia, Wyandotte, mixed into a semi-liquid mass, to be applied to the article and rinsed off by clear water.

METHOD FOR SPONGING, SETTING AND FINISHING FABRICS.—E. HEIDLER, care of Sykes, McCole & Potter, 170 Broadway, New York, N. Y. The object of the invention is to provide a method whereby the fabric is treated in open width and delivered in practically the same length as the original piece. Another object is to render the operation continuous thus avoiding handling the goods during any stage of the process. The method consists of sponging, fixing, and setting the fibers, ironing the fabric and cooling and simultaneously moistening it, the several steps being carried out while the piece of fabric is traveling in the direction of its length.

MATCH STAND.—R. L. WHITENER, Box 401, Charlotte, N. C. The invention has for its object to provide a device wherein a holder of transparent material is provided for matches, and wherein advertising matter may be arranged within the holder, the holder being closed at the top, and at its bottom a hopper through which is slidable a plunger having grooves for receiving individual matches to remove them from the holder, the hopper being held in place by the plunger, which is removable to permit the removal of the hopper for the insertion of matches.

Hardware and Tools

TOOL HOLDER.—M. S. HILL, 183 Hall St., Brooklyn, N. Y. The invention relates particularly to a construction of holder for electricians, wiremen, linemen, and other workmen, the object being to provide means to be readily attached to the belt or clothing of the workman for holding tools in position for instant use. Another object is to provide a clip readily applied and readily removed, formed with a socket and a pair of spring hook members for supporting the tools.

CLOTH CUTTING KNIFE.—J. APPLEBAUM, 106 E. 19th St., New York, N. Y. Among the principal objects of the invention are, to provide a knife for employment in connection with reciprocating machines of conventional type for cutting piled cloth, to provide a knife sharpened at opposite ends to augment the service period of the knife, and to diminish the quantity of metal necessary to the manufacture of knives of the character mentioned.

COIN-COTROLLED LOCKS FOR LOCKERS.—S. L. FLOWERS, Nampa, Idaho. The invention relates to coin-controlled locks for lockers designed for public uses in public places. Among the objects are to provide a special type of key and a special type of tumbler practically impossible of imitation, to provide positive baffles against the picking of the lock, to provide an automtaic spring detent for the bolt in either of its two positions, to provide a bolt stop, adapted to be rocked out of position by a coin in one position and by a key in the other position, to provide such device in inexpensive form occupying but little room in a lock.

Heating and Lighting

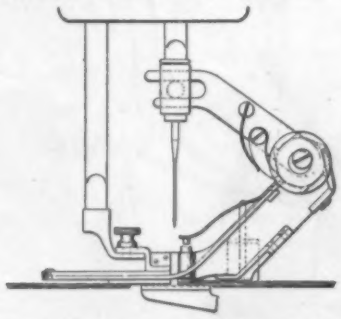
STEAM BOILER ATTACHMENT.—A. GOLLINGE, 100 Featherbed Lane, Bronx, N. Y. The object of the invention is to provide an attachment for stationary steam boilers such as are used for generating steam for heating and power purposes and arranged to insure proper combustion of the coal or other fuel and to utilize the latter economically and to the fullest advantage. In order to accomplish this result use is made of a ue in the form of a goose-neck leading from the smoke box to the boiler, a drum in which terminates the flue, a chimney flue leading from the drum to a chimney, and retarding and deflecting means in the drum at the junction of the flue and the drum.

BOILER.—R. F. E. OKRASSA, Antigua, Guatemala. An object of this invention is to provide a boiler arranged without an ash pit within the boiler. Another object is to provide means for agitating sediment between the fire box and the shell, and to permit drawing off such sediment thereby keeping the boiler clean and allowing a free circulation of the water in the shell. To accomplish this, use is made of a tubular fire box arranged within the boiler shell and an open annular frame connecting the bottom of the fire box with the bottom of the shell, the latter and the fire box having openings in register with the openings in the frame.

MECHANICAL STOKER.—H. E. KLEFFEL, care of P. H. Butler, R. 825, 30 Church St., New York, N. Y. Among the objects of the invention is to be provide a mechanism whereby the fuel may be introduced from a single hopper and more evenly distributed along the fire bed than has been possible heretofore. Another object is to improve the connections between the feeder mechanism and the movable grate devices whereby both sets of the devices may be operated simultaneously and from a single source of power.

Machines and Mechanical Devices

HEMSTITCHING ATTACHMENT.—E. C. HARRIMAN, 154 Main St., Northampton, Mass. The invention relates to an attachment for sewing machines. A specific object is the provision of an attachment which is applied to the presser foot of a sewing machine and has a swinging arm connected with the needle bar, whereby the lateral feeder of the attachment is brought into



A SIDE VIEW OF THE ATTACHMENT APPLIED TO A MACHINE

operation to move the cloth back and forth laterally in timed relation to the forward feed produced by the regular mechanism of the machine; the device is so designed that it can be applied to a machine without any change in the construction.

MULTIPLE SIGNATURE MACHINE.—W. F. WILLIAMS, P. O. Box 100, Miami, Ariz. Among the objects of this invention is to provide a multiple signature machine with facilities for transmitting the motion of the hand to all of the pens of the system so that the motion of the master pen will be faithfully reproduced by all of the auxiliary pens. The invention provides facilities for more delicately adjusting the elevation and control of the pen bar and facilities for doubling the number of signatures successfully and simultaneously.

APPARATUS FOR GROOVING SUGAR-CANE-CRUSHING ROLLERS.—E. ABARCA, 30 Ferry St., New York, N. Y. Among the principal objects which the invention has in view, are, to facilitate the operation of cutting inclined grooves in a roller for macerating sugarcane, to automatically control the circular feed of the roller, during the cutting of the grooves, to provide means for accurately spacing the grooves to be cut, and to reduce the cost of cutting the grooves.

GANG DRILL FOR CUTTING COAL.—D. B. STAUFT, Uniontown, Pa. This invention relates to coal mining machinery and has particular reference to drilling devices for boring a plurality of holes simultaneously in definite spaced relation for the purpose of weakening the natural structure for subsequent reduction by blastings, or for the purpose of making a substantially clean cut by repeated drilling operations or removal of the minimum amount of material where the cut is being made.

GOLD SAVING DEVICE.—A. BAYTON, care of New Kenwood Hotel, Manila, P. I. The prime object of the invention is to provide disintegrating mechanism to be employed in connection with sluice boxes of gold dredges and so arranged as to break up and reduce all clay and sticky gold-bearing material so that the same can be thoroughly washed and made to give up any gold it contains before passing over the tail of the box. The object is attained by a disintegrating wheel disposed in the path of the material passing through the sluice box.

Medical Devices

STRETCHER.—J. L. BORDMAN, care of Anaconda Copper Mining Co., Butte, Mont. The invention relates more particularly to a stretcher adapted for the transportation of persons injured or disabled in mines or quarries. An important object is to provide a stretcher embodying means to effectively strap an injured person and support him with minimum discomfort as well as to provide a frame having protecting elements to guard the person on the stretcher against injury by contact with adjacent walls or objects, and that he may be handled with the maximum ease and comfort, to be slid or dragged up or down shafts, ladders and steep embankments without danger of injury.

Prime Movers and Their Accessories

INTERNAL COMBUSTION ENGINE.—C. J. MENASCO, Birmingham, Ala. The invention relates more particularly to that type of engine including opposed pistons, an object being the provision of an engine having means to prevent pressure and power loss in the exhaust ordinarily resulting from but partial expansion of the gases in the usual engine cylinder. A still further object is to provide an engine having effective connections between the pistons, and a power shaft including means by which the pistons are moved in one direction, and one of the pistons controlled during each cycle of operation between the explosions.

Railways and Their Accessories

LOCOMOTIVE DRIVING-BOX AND CONTROLLING CONNECTION THEREFOR.—H. B. FURSTONDURG, Shreveport, La. The invention relates generally to the driving-boxes of locomotive wheels, through which the wheel axles pass, the prime object being to provide means which will normally hold the driving boxes and their adjacent parts in operative relation without undue friction, and which permit of the driving boxes either together or independent without dropping the wheels, and in such manner that, upon removal of one driving box of the pair, the parts, when again connected, will not require adjustment.

Pertaining to Recreation

TOY.—W. T. CRAMP, 64 Pine St., Poughkeepsie, N. Y. The object of the invention is to provide a toy provided with a pair of manikins capable of performing at the will of the operator various acrobatic stunts. In order to accom-

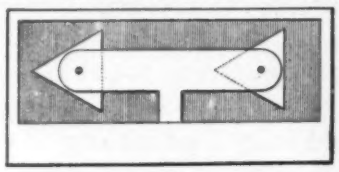
A SECTIONEL SIDE ELEVATION OF THE TOY

plish the desired results use is made of a cord held in tension and two manikins, of which one is heavier than the other, the manikins having integral arms and hands rigidly connected with each other at the hands, the latter engaging the cords.

Pertaining to Vehicles

BOW TURNING MACHINE.—G. A. ENSIGN, Defiance, Ohio. The object of this invention is to provide a bow turning machine especially designed for accurately and uniformly turning the side or end members of the bows used for supporting the tops of automobiles, wagons, carriages, and other vehicles with a view to insure proper fitting of the said bow members in sockets fixed on the vehicle bodies. Another object is to enable the attendent to readily reach the controlling means of the machine without changing his position.

DIRECTION-INDICATING SIGNAL FOR AUTOMOBILES.—F. N. MOORE, 515 Illinois Ave., Peoria, Ill. One of the principal objects of the invention is to provide a signal for use upon automobiles by day or night, whereby to indicate to approaching or following vehicle drivers



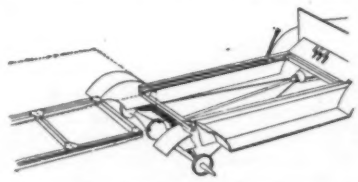
AN ELEVATIONAL VIEW OF THE SIGNAL

any intended maneuvers on the part of the vehicle carrying the signal. The invention provides a signal of the type in which an arrow is used for indicating the direction of the turn to be made, the construction being such that the head and tail of the arrow, which are formed of equilateral triangular plates, may be moved at will in unison to attain positions for reversing the directions in which the arrow points.

AUTOMOBILE-LIFTING APPLIANCE.—O. A. VICTEL and M. E. PORTER, Tolley, N. D. The object of the invention is to provide a simple, inexpensive and efficient lifting hook to facilitate the elevation of the forward portion of a Ford automobile for purposes of repair and substitution of parts, and to obviate all danger of slipping and avoid all contact of the lifting chains or connections with the adjacent portions of the frame and body of the machine.

VEHICLE FOLDABLE TOP.—O. E. P. FRANZ, 120 49th St., Corona, L. I., N. Y. The objects of this invention are to provide a foldable top whereby the rear part of a closed automobile may be easily and quickly collapsed to transform the car into a semi-open or totally open car depending on the construction, to provide a top which will colapse in a manner not to deform the general appearance of the car, and which can be collapsed from within by a mechanism manually operated or from motive power of the vehicle.

DETACHABLE AUTOMOBILE BODY.—W. H. WOCHNER, 1608 Stone St., Falls City, Neb. The invention relates particularly to an arrangement whereby the body of an automobile may be quickly applied or removed, the object being to provide a simple construction which may be



PERSPECTIVE VIEW SHOWING AUTOMOBILE WITH INVENTION APPLIED

formed as part of the automobile or which may be made independently and attached thereto. A further object is to provide frames forming a runway, one of which is mounted on the chassis, the other on the body of the automobile, whereby the body may be slidingly fitted into position.

TRACTOR.—H. H. LINN, address The Linn Mfg. Corp., Morris, N. Y. This invention relates to tractors of the caterpillar type, one of the main objects being to provide interlocking sections joined by means of pins which are properly lubricated and absolutely dust-proof. Another object is to provide a flexible carrier for the anti-friction rolls which permit of automatic adjustment to accommodate the caterpillar to all road conditions, whereby maximum traction is assured.

GRAVEL BOTTOM FOR WAGON BEDS.—W. H. WILTSHIRE, Gilliesprieville, Ohio. The invention has particular reference to the construction of a wagon body for the conveyance of sand, gravel or other like commodities. Among the objects is to provide an arrangement of the body bottom whereby the movable planks used for dumping purposes, are all interlocked with one another and with the side panels, the locking of the bottom planks being practically automatic subject to a final action of a simple part to provide a body so constructed as to prevent the lateral spreading of the side panels and practically eliminate leakage.

Designs

DESIGN FOR A FLAG, PENNANT, SIGN, EMBLEM OR ARTICLE OF A SIMILAR NATURE.—F. SMITH, 1275 Union St., Brooklyn, N. Y. This design represents the American Eagle surmounting the Liberty Bell on which is shown a cross with a star in the center of the cross: the design is displayed in the center of a medallion.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of patentee title of the invention, and date of this paper.

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The President of the United States will soon announce by proclamation, a Registration Day to be held as early in September as possible.

More than 2,000,000 men are needed to put our army on a 5,000,000 men basis. 13,000,000 are expected to register.

Class one is nearly exhausted. This Class must be replenished from new registrants not later than October 1st.

Who must register:

All men from 18 to 20 years of age, inclusive and
All men from 32 to 45 years of age, inclusive, should watch closely for the President's Proclamation, definitely designating who must register.

Where you will register:

In the customary voting precincts in the jurisdiction of your Local Selective Service or at other points to be designated.

Sick and non-resident registrants:

These will be furnished cards by their Local Boards. The sick will be registered by persons deputized to do so. Non-residents may register by mail through the County or City Clerk of the place at which they are stopping. Special provision will be made for felons, persons awaiting trial and others confined in jails or institutions.

The Government of the United States asks your hearty co-operation with your Local Board in making the registration a complete 100% catalogue of every man of the ages to be announced in the President's Proclamation. Selection will take place later by the usual classification method.

The penalty for failure to register is one year imprisonment and NO man can exonerate himself by the payment of a fine.

WATCH FOR REGISTRATION DAY!

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At the Other End of the Phonograph

(Concluded from page 164)

is a constant force and a gravity motor can be relied upon to maintain a definite speed. The recorder, in turn, is moved across the face of the disk by a long threaded shaft with which it engages; and by using various threads the number of grooves cut to the inch can be varied. In this instance the record is of the up-and-down or so-called "hill and dale" cut, as distinguished from the lateral cut. The Packman process of recording is employed, permitting of a large number of grooves to the inch.

Much depends on the wax disk. Its surface is carefully prepared so as to be absolutely flat and smooth and free from imperfections of any kind. Preparatory to being used, the wax disks are kept in a cabinet that is electrically heated so as to maintain a constant temperature. When a selection is to be recorded, the wax disk, measuring a half inch or more in thickness by the usual diameter of the standard record, is placed on the turntable. The gravity motor is started and the producer tool placed the proper distance in from the edge. The buzzer signal is given to the orchestra leader at this time, and with the cutting of the required number of blank grooves the second or "start" signal is given.

This part of the work is in charge of a recording expert who has been in the phonograph industry since the time of the original Edison tinfoil records. As the record is being cut the recorder examines the grooves with a powerful magnifying glass so as to make sure that they are being properly formed. All the while a stream of air is blowing on the cutting tool so as to disengage the wax shavings, while another tube sucks away the cuttings. A stop watch on the wall indicates the playing time of the record being made, which is checked up with the time limit set beforehand.

Checking Up the Test Record

The first wax record is a so-called test record. At the time the writer was in the recording room, Madame Easton of the Metropolitan Opera Company had just completed a well-known operatic selection for the test record, when she entered the recording room, in company with the musical director and several musicians.

In a few moments the recording staff had substituted a reproducer with a small tin horn for the recording member, and the selection was being repeated in miniature, so to speak. Madame Easton and the musical director, as well as the recording staff, pressed close to the tiny horn so as not to lose a single note. Meanwhile the director, with the musical score in his hands, followed the selection. Here he pointed out a loud note which had to be subdued; at another point he pointed out the weakness of the accompaniment; at still another he criticized the poor enunciation of a word, and so on. Indeed, he was "reading" that record, just as the editor proofreads and revises this page before the reader ever sees it.

Then the little group filed out of the recording room back to their places on the other side of the partition; and a few minutes later the selection was again being recorded, this time with corrections.

Surely, the recorder in charge of the work should know something about sound waves. He had been capturing and "canning" them for the past three decades or more. Here was an authority who could tell us something about sound. Yet in answer to the writer's question he gave this startling reply: "I know practically nothing about sound. Every day I come across some new peculiarity; and it is only by constantly watching out for the tricks of sound waves and meeting them with counter-tricks that we make good records!"

Still, this gentleman can tell us something about those tricks which he has encountered and countered. He explains how some instruments reproduce better than others. The violoncello is a veritable trouble maker, so it seems: in orchestrations it is generally replaced by some brass instrument that approximates its deep, vibrant notes. Yet in solos the violoncello goes well. The piano is a poor reproducer alone or in company; in fact, it is perhaps the poorest of all, and is avoided as far as possible. The violin is excellent.

When it comes to making up an orchestra or band for a record, the known recording properties of the instruments are the guiding consideration, and the *ensemble* is arranged accordingly. Indeed, there is a limit to the size of an orchestra or band for recording purposes, beyond which no additional effects are produced. In fact, interference is apt to set in. For accompanying a singer the orchestra need not exceed eight or ten players for giving the effect of a large theatre orchestra, provided each instrument is in the hands of a talented musician.

All of which goes to say that orchestras and bands for recording purposes and for concert purposes are totally different propositions.

Electrotyping at Its Highest Development

After the wax record is completed, the wax is allowed to set or become hard. The test record is thrown out after having served its purpose, for the reason that the grooves of soft wax have been more or less ruined by the steel needle of the reproducer. In the instance of the accepted master record, there is no telling how it sounds until it has passed through the various processes leading up to the first molded record.

The wax master is carefully covered over with fine powdered graphite, which is brushed evenly into every groove and hollow. It is then suspended in an electroplating tank and subjected to a weak electric current for a period of 45 to 50 hours. The weak current necessitates a long immersion in the plating bath, and the deposit, in consequence, is extremely fine grained. The thin shell of copper deposited on the graphited wax, carrying every groove and variation of the master, is stripped from its support and soldered on a heavy brass disk, after which it is nickel plated to harden its surface. This electrotype, to give it the proper name, is the "master."

A second electrotype operation now follows. The nickel-plated master is treated with acid to prevent the next copper plating from sticking, and it is placed in an electrotyping tank for a period of 50 hours. The thin copper shell is then removed and mounted on metal, and the electrotype thus obtained is called the "mother." The mother is nickel-plated, treated with acid, and placed in the electroplating tank in order to produce still another electrotype, which is known as the "matrix" and from which the commercial records are molded.

So from the wax record to the finished product there are the master, mother, and the matrix electrotypes. Should anything happen to the matrix, a new one can be made from the mother; and should anything befall the matrix and the mother, the process can be restarted from the master, which is kept in the vaults of the organization.

Every step in electrotyping must be carefully done, for like a chain the finished record is no better than the poorest work (the weakest link) of any department. Expert engravers examine the electrotypes, starting at one end of a groove and tracing it over hill and dale some half mile or more to the very end, armed with a powerful magnifying glass and an engraver's tool. Little burrs and other slight imperfections of electrotyping are removed with a miniature chisel. All the while, however, due care must be taken not to remove or damage the "music" at the bottom of the groove. Electrotypes are delicately polished on high-speed spindles with soft rags and cleaning liquids. Inspections with magnifiers are frequent throughout the process.

The ultimate product of this studio is the sample record which is molded from the matrix. When this sample or file record passes a most exacting test, the matrix is approved of and shipped to the factory where the records are turned out in large numbers for the phonographs of the world.

Ships of Stone—1849 to 1918

(*Concluded from page 165*)

from 53 to 67 feet, and has a draft of 7 feet 9 inches, with total displacement of 783 tons. It, like the Panama pontoons, has withstood severe treatment from the ferries using it as a landing stage.

The next development was a motor cruiser of concrete. Several members of the Sabin Hill Yacht Club, Dorchester, Mass., got together in 1916 and built such a craft, christening it the "Wanderer." She is 41 feet over all, with a beam of 8 feet. Either kerosene or gasoline may be used for the 30 horse-power engine, the fuel tanks holding 1,000 gallons, or a supply sufficient for a cruise of 40 days. The boat is equipped with apparatus for developing motion-picture films.

The year 1917 must be recognized as the banner one for the concrete boat. In the first place, a new geographic field was thrown open to the operations of the new idea when the Scandinavian builders turned their attention to the fabrication of ships of stone. In Sweden was built a 200-ton concrete boat of rather fine lines, the "Malmo." At Porgsrund, Norway, the manufacture of concrete lighters was taken up with the utmost care by a big cement works, which launched its first boat in August, after having furnished a nine-foot model to the United States Bureau of Standards for the purpose of having the methods of construction studied. The Porgsrund plant builds its boats bottom up, an internal mold being used that can readily be taken apart and reassembled. The vessel is launched in the same position as built, interior compartments being so arranged that the admission of a small amount of water causes the vessel slowly to right itself.

At the same time, the Fougner system, described in some detail in the SCIENTIFIC AMERICAN of January 26th, 1918, was being perfected at Moss, Norway. Mr. Fougner, who had had experience in constructing some years before, at Manila, a concrete vessel, more or less as an experiment and an engineering recreation has perhaps made greater strides than any other single exponent of the stone ship. He has turned out a number of 100-ton lighters; in the Namsenfjord he produced the first concrete vessel intended for actual ocean navigation; and he has developed a most interesting type of floating dry-dock of concrete. Within the past year or so he has been instrumental in organizing several concrete shipbuilding plants in the United States.

France has likewise come to the fore within the past two years. A decidedly large lighter was turned out for the Paris Ship Canal during 1917, while at another plant in Bordeaux a number of launchings were held. At the confluence of the Marne and Seine was poured a concrete barge 150 feet long by 26 feet wide, of 700 tons dead weight. This craft, together with at least two other large barges produced in France in 1917, were manufactured in accordance with the Lorton system, described in *Concrete and Constructional Engineering* (London) for April, 1918. And finally, French influence is to be traced in the concrete barges along the Piave, by means of which the Italian army has transported heavy guns for operations against the Austrians. It will be understood that the guns are not merely transported on these barges, but that the concrete mass actually serves as a floating gun platform from which firing is done.

It is here that the tale of concrete ships becomes too heavy for the cataloguer. It is enough to mention the yards at Montrose, Scotland; at Montreal; on the Thames near London; and at Barcelona, Spain, as examples indicating the extent to which the idea has caught on. As for the United States, it would be futile to try to name the places where concrete ships of one sort or another have been successfully produced within the past 18 months. With the climax offered by the "Faith" and her successful trial trip, the first chapter in the history of the concrete ship may be said to have been closed; and hereafter it will be in order to chronicle only those builders who succeed in bringing out some brand new principle of concrete ship construction. The mere building of a concrete ship will possess hardly more significance than the building of a vessel of wood or steel.

A Two-Cycle Super-Induction Gas Engine for the Automobile

(*Concluded from page 171*)

as a pumping chamber and this not only prevents the loss of the fuel gases being pumped, but also prevents the burnt gases from being drawn back into the pumping chamber.

From the mass of data which the inventor has submitted to the writer, it would be possible to write thousands of words on this most interesting engine. However, space does not permit more than a mere outline of the main characteristics of this engine, which, it seems, has a brilliant field before it.

In conclusion, the general specifications of the Augustine engine are as follows: Number of cylinders—six, each having double-acting piston utilized both as power piston and pump; bore of working cylinder is equivalent in area to 4⅝ inches conventional piston; stroke, 4 inches; area of working piston, 16.7 square inches; area of pump, 23.76 square inches; connecting rod crank ratio, 4 to 1; bore of crank case, 10¼ inches; overall diameter of engine, 26 inches; overall length, 24 inches; two-spark magneto driven 3 to 1, giving six sparks per revolution; approximate weight of engine, two pounds per horse-power; compression from 90 to 100 pounds per square inch; positive system of force-feed lubrication.

Strategic Moves of the War

(*Concluded from page 166*)

Georgians and Cossacks of the Don a center of assistance and also much needed war material in their struggles against the Germans and the Turks. As far as can be learned, the British troops have taken over a part of the defences of Baku and are operating under a Russian general as commander-in-chief. It would seem that, in case of a successful resistance to the Turks now, a useful pro-ally center can be established and that the Allies can not only hold Baku but can control all the Caspian transport. Possession of Baku takes away from Germany all control of the great oil fields of southern Russia and cuts off her free entrance to Central Asia of which she has so loudly boasted. While the Caucasus region has many active and no doubt also many undeveloped oil fields, the only really great source of supply is at Baku. Germany holds the Black Sea port of Batum connected with the oil supply of Baku by pipe lines but there are no great wells in its vicinity.

The great problem of Russia is bringing forward one or more new war fronts that promise to develop into serious centers to bar German progress in the east. Late reports mention the arrival at Vladivostok in Siberia of American troops from Manila and of Japanese forces. These are to assist the Czecho-Slovaks and Siberians who are opposing the Bolsheviki, Germans, and Austrians, in the section of the Trans-Siberian railroad east of Lake Baikal. It can hardly be expected that the latter can offer any serious resistance to trained American and Japanese troops, sufficiently armed and equipped. There are Allied forces that are operating one hundred and miles south of Archangel on the White Sea, and there are also Allied troops coming south from the Arctic on the Murmansk railway. It is apparently expected that these columns, together with loyal Russians, will be able to join at Vologda where they can come into communication with the Czecho-Slovaks who are fighting on the Volga River. If all the Allies' efforts receive the good support of the best and most intelligent elements of the Russian people, it would seem as if the Bolshevist forces could be surrounded in some manner and so thoroughly defeated that the re-establishment of an eastern front might pass from a theory to a fact.

NEW BOOKS, ETC.

THE CADET MANUAL. Official Handbook for High School Volunteers of the United States. By Major E. Z. Steever III, U. S. A. and Major J. L. Frink, U. S. A. Philadelphia and London: J. B. Lippincott Company, 1918. 8vo.; 348 pp.; illustrated. Price, $1.50 net.

The High School Volunteer movement, now in its seventh year, is designed to lay the foundations of a better citizenship. It utilizes the apparatus of the high school system and the play instinct of the student, in combination with military discipline plus interschool competition and national organization. Boy psychology is fully taken into account. It aims at mass or group athletic activity shorn of its present objectionable features, with the accentuation of character building. The Manual has the two-fold features of a text and a reference book, and covers the first year of a three-year course. It takes up regulations, drill, the rifle, signaling, physical training and wall scaling, and leaves full scope for the individual instructor. The Secretary of War is president of the national organization, which has the support of noted educators; already the membership is 20,000, and the movement has so many desirable features that it will doubtless continue to grow in numbers and strength.

AIRCRAFT MECHANICS HANDBOOK. A Collection of Facts and Suggestions from Factory and Flying Field to Assist in Caring for Modern Aircraft. By Fred H. Colvin, A. S. M. E., Editor of *The American Machinist*. New York: McGraw-Hill Book Company, Inc., 1918. 8vo.; 500 pp.; illustrated. Price, $3.00 net.

The demand for mechanics in connection with our projected air fleet is insistent, and will rapidly become clamorous. Inefficiency and guesswork must not imperil the success of the program, and mechanics must have a sound, reliable knowledge of details in order to inspect, adjust and repair quickly and thoroughly. Not only the life of the pilot, but also the lives of troops and the failure or success of great military movements may hang upon the efficiency of the mechanics. The author has given us a worthy work dealing with the duties of the machinist or fitter, and the rigger or plane man. Construction, engines, military training specifications, assembling, training camp work, instruments and machine guns are the main subject headings, under which are grouped pregnant facts and suggestions.

PRINCIPLES OF MECHANISM. By Walter H. James and M. C. Mackenzie, Massachusetts Institute of Technology. New York: John Wiley and Sons, Inc., 1918. 8vo.; 250 pp.; illustrated. Price, $1.50 net.

The authors make a well-considered effort to supply a text adapted for use in evening technical schools and trade schools, presenting elementary principles in as thorough a manner as is possible without resorting to higher mathematics. The definitions are good, the exposition plain; typical problems are solved, and many others are given for the student's solution.

NATIONAL PROGRESS. 1907-1917. By Frederic Austin Ogg, Ph.D. New York and London: Harper and Brothers, 1918. 8vo.; 447 pp.; illustrated. Price, $2 net.

This 27th volume of "The American Nation" series deals with a decade full of significant events and pregnant mental attitudes. We have just passed through a most critical period characterized by reactions political, social and industrial; our democracy has been threatened by forces within and without. All these conditions, movements and tendencies are canvassed in a critical yet reasonable way in this review of national progress. To insure an intelligent understanding of causes, two chapters take us back to 1900. The currency and tariff, railroad regulation, corporations, labor, conservation and reclamation, all receive their share of attention; passing to wider interests, the author surveys our colonial policy, the guardianship of the Caribbean, the Mexican imbroglio, the Pacific and Asia, and neutral rights. Preparedness and wartime policies are dealt with in the same careful and comprehensive manner, and six maps graphically portray conservation projects, protectorates, and elections.

ADVERTISING AND SERVICE. New York and London: A. W. Shaw Company, 1918. 8vo.; 330 pp.; illustrated.

Advertising is, or should be, as studied a part of the banking business as of any other service designed to reach the people. The advertising campaign must be preceded by an accurate analysis of the field, and should disclose the forces for and against, so that the former may be brought under intelligent control, and the latter neutralized as completely as possible. These important steps are made plain in "Advertising and Service"; the selection of mediums, preparation of copy, and handling of outdoor and special advertising are presented in chapters full of telling points. Profitable direct advertising is the subject of the second part of the volume; the sort of service that holds business is the theme of the final section. Bankers will find here business-getting plans that have actually increased deposits for other bankers.

BOMBS AND HAND GRENADES. By Capt. Bertram Smith, Bombing Instructor with the Canadian Expeditionary Force. New York: E. P. Dutton and Co., 1918. 8vo.; 90 pp.; illustrated. Price, $2 net.

Explosive missiles are playing a great part in trench warfare. Capt. Smith here presents them in all their forms, British, French and German, bombs, rifle- and hand-grenades and fuzes, with explicit instructions and precautions as to their preparation and use in attack and defense. In most cases a detailed diagram accompanies the description; both officers and men will find the work a primer of vital information, simple indeed to understand, yet covering all necessary points of type, construction and use.

THE EXPANSION OF EUROPE. (1415-1789.) A History of the Foundations of the Modern World. By Wilbur Cortez Abbott, B.Litt., M.A., Professor of History in Yale University. New York: Henry Holt and Company. 8vo.; 975 pp.; illustrated. Two volumes. The set, price, $6.50 net.

It is the modern world that is kept strictly in view in this original treatment of historical material. The work traces the path by which we have progressed to our present state of civilization, and dwells rather upon the extension of knowledge, the development of science and invention, and their bearings upon our ideals and our standards of living, than upon the superficial eccentricities of courts and kings. Step by step, we come to see the gradual modification of the conditions of life, the slow but sure change in ideas and ideals. Much space is given to the reactive influence of colonization on European life and affairs. These steps are further indicated in a visual manner by excellent maps and carefully prepared charts and illustrations. Nothing is more educative than a new way of looking at things, and certainly a fresh viewpoint is the leading characteristic of this new work; motive and meaning are lifted out of the confusion of pomp and circumstance to take their true place in the world development here unfolded.

RAYMOND, Or Life and Death. With Examples of the Evidence for Survival of Memory and Affection After Death. By Sir Oliver J. Lodge. New York: George H. Doran Company. 8vo.; 415 pp.; illustrated. Price, $1.50 net.

This is three very dissimilar books in one. Part I, which the distinguished author himself calls the "normal portion," is a collection of letters from his son at the front; it gives us a vivid glimpse of conditions and enables us to form some judgment of Raymond's character. Part II, "supernormal portion," deals with the alleged communications made, through mediums, by Raymond to his family, after the enemy's shrapnel had put an end to a promising young life. Part III, "Life and Death," is a most felicitous expression of the scientist's philosophy, and many will regard it as the cream of the volume. The eminent sanity of the man, and his judicial attitude, is revealed in the chapter on the "Attitude of the Wise and Prudent." The reader primarily interested in the human side of the war will delight in the correspondence of the first part; those who, whether morbidly or scientifically, are interested in spiritistic theories, will find the second part absorbing; and all thinkers, of whatever color of mind, should appreciate the final survey of life and consciousness, with its illuminating disclosure of the author's philosophy and belief, as a frank confession not to be lightly considered.

THE BUSINESS OF WAR. By Isaac F. Marcosson. New York: John Lane Company, 1918. 12mo.; 319 pp.; 16 illustrations. Price, $1.50 net.

When the author of "The Rebirth of Russia" turns his pen to such a subject as this, we may be sure that before finishing the book our conception of what it means to supply an army equal to the population of Greater New York will be wonderfully enlarged; and the hero of this true romance, who is responsible for the feeding, clothing and equipment of this khakied host and the furnishing of horses and the mules enough to work all the farms in Iowa, to say nothing of a fleet of mechanical transport containing one-sixth the number of all the commercial motor vehicles in the United States—this man is Lieut.-General Sir John Cowans, K.C.B., Quartermaster General. Under his keen eye, aided by others who receive deserved notice in this volume, the red tape has been cut, the principles of big business have been applied to war, and the result is "the most amazing business institution" the author has yet seen—and he has seen and studied many such institutions here and abroad. The value of the work, aside from the intellectual pleasure it offers, is inestimable; if our own leaders will but take its lessons to heart we may indeed make this conflict, as the author hopes, an immense training school for that inevitable war after the war.

AIRCRAFT AND SUBMARINES. By Willis J. Abbott. New York and London: G. P. Putnam's Sons, 1918. 8vo.; 400 pp.; illustrated. Price, $3.50 net.

This substantial and attractive work deals with the new weapons of warfare, aircraft and submarines. Looking back down the years we find that both human flight and under-water navigation have occupied inventors for ages; but only recently have practical results been secured. The development of these arts in the present war is nothing short of phenomenal; this the writer makes plain in his popularly-worded papers; the very rapidity of development has handicapped him in his effort to present the latest types. Altogether, however, the work is a successful popular presentation of an enthralling subject. There are thrilling stories of high-air and deep-sea exploits; what relation all this progress bears to the coming days of peace is shown, and full-page plates in color, with numerous other illustrations, supplement the text. Among these are escapes from burning balloons, airplane raids and accidents, submarine interiors, anti-aircraft guns, and a page of American aircraft depicting various types and models.

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Each Long Cooling System is especially designed for the motor with which it is to be used. Each step in creating the design is taken in cooperation between our Engineering Department and that of the manufacturer. The result is highest efficiency at lowest possible cost.

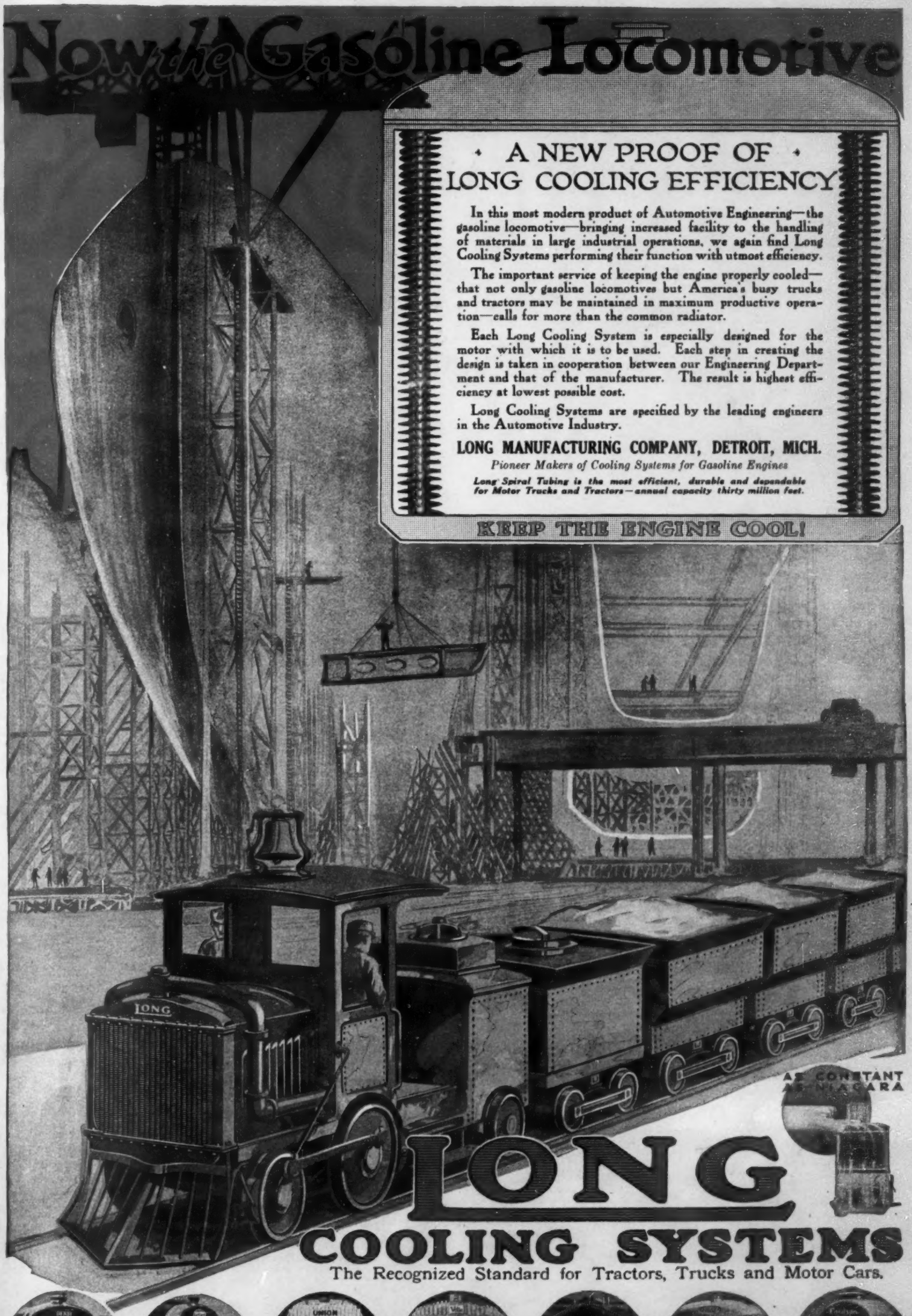
Long Cooling Systems are specified by the leading engineers in the Automotive Industry.

LONG MANUFACTURING COMPANY, DETROIT, MICH.

Pioneer Makers of Cooling Systems for Gasoline Engines

Long Spiral Tubing is the most efficient, durable and dependable for Motor Trucks and Tractors—annual capacity thirty million feet.

KEEP THE ENGINE COOL!



AS CONSTANT AS NIAGARA

LONG COOLING SYSTEMS

The Recognized Standard for Tractors, Trucks and Motor Cars.

Made in more than 60 different Designs adapted to every type of Motor Vehicle

Rushing the Grain to Hungry Millions

These pictures will illustrate the widespread application of Federals to grain haulage: upper view, in the wheatfields of Southern Michigan; oval, in the Southwestern rice fields; lower, hauling Milo Maize on the good roads of California.

Federal Motor Truck Co.
Detroit Michigan

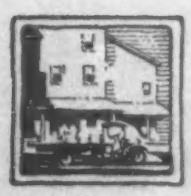
THE greatest grain crop in the history of the nation—the greatest army to be fed in the history of the nation—war-stricken peoples of allied nations depending on America for bread—

Here surely is a real opportunity for motor trucks to prove their superiority over old methods of moving the grain crop.

And Federals are meeting it—just as they are meeting every other haulage problem.

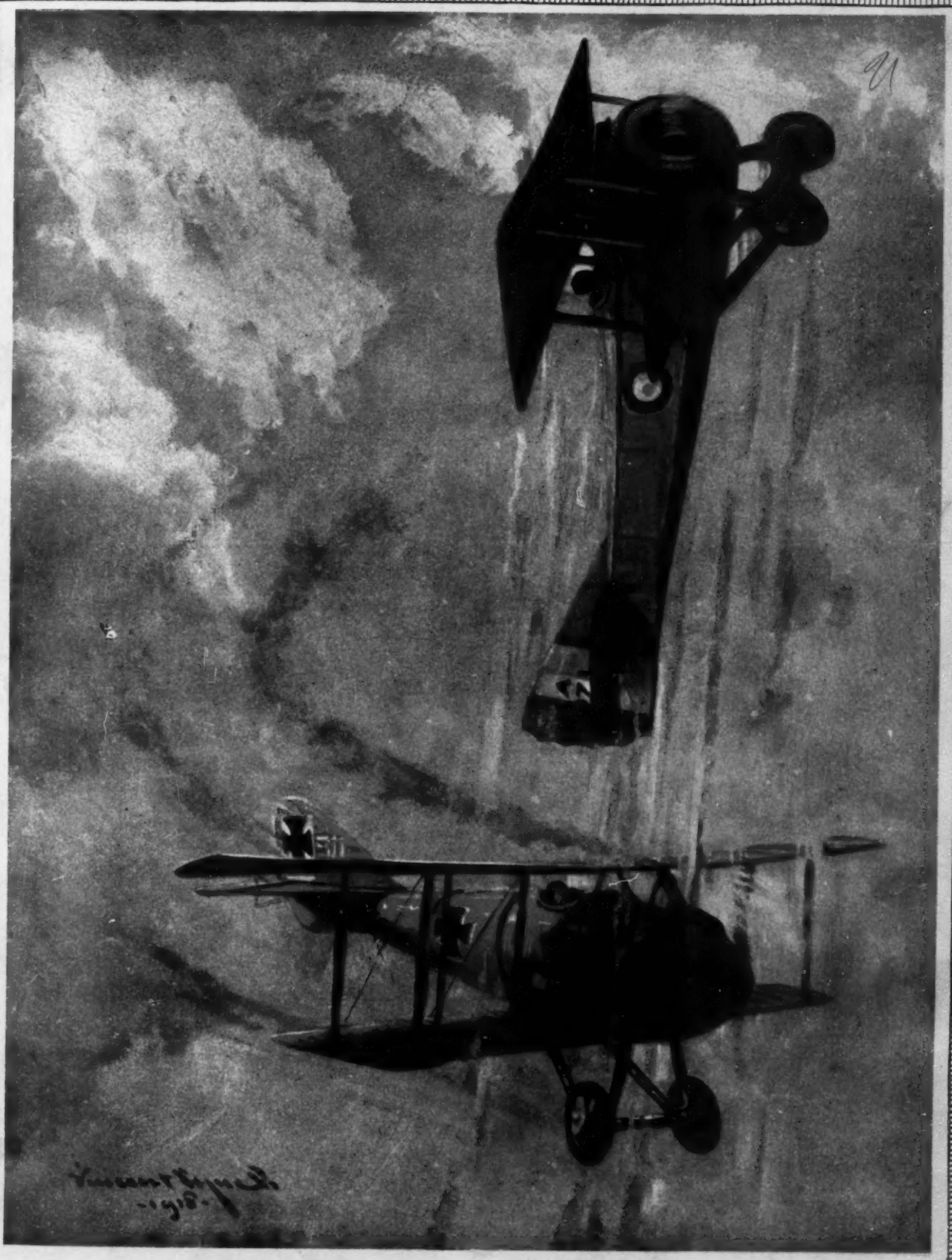
In many instances they carry the grain from field to granary and thence on to the elevators at the great mills of the northwest, in this way avoiding the former need for storage of grain at small wayside elevators.

Motor truck haulage, as this application of Federal illustrates, has arrived most opportunely to aid in solving haulage problems of vital importance to our country.



FEDERAL

SCIENTIFIC AMERICAN



SWEEPING UPWARD AND HANGING BY THE PROPELLER TO SHAKE OFF A PURSUER [See page 188]

September 7, 1918

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents

AWAR MESSAGE

TO WHITE TRUCK OWNERS

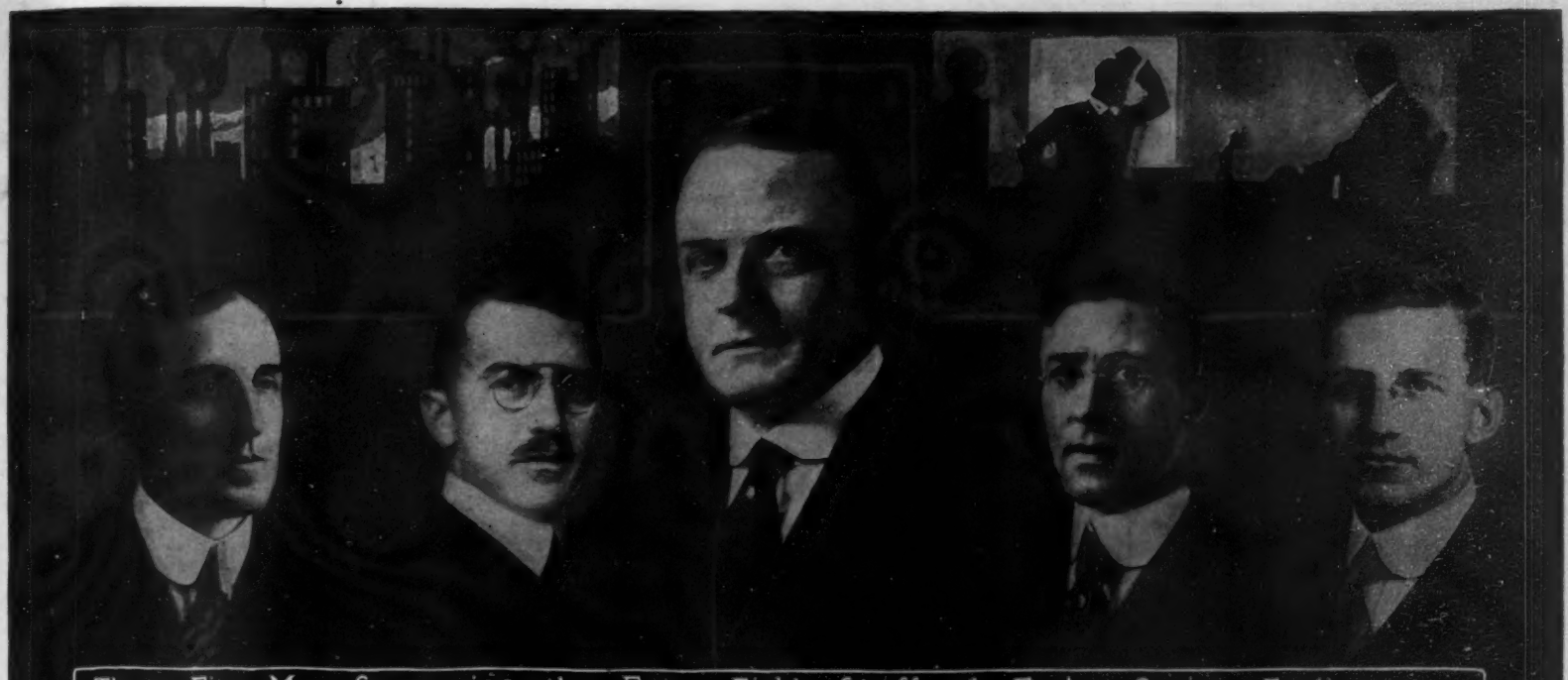
THE use and demand for White Trucks in war service by both the United States and French armies has reached such proportions as to seriously affect deliveries of commercial units until production at the factory overtakes urgent military needs.

While this will delay the immediate filling of commercial orders, there will be no interruption in the making and distributing of parts, which will continue to be supplied as promptly and as abundantly as ever. White Service will efficiently provide for the many thousands of White Trucks operating in all parts of the country.

The company makes this public explanation for the assurance and protection of its innumerable customers and prospective customers, in the confident belief that they will recognize and approve a course of action which puts the national welfare first.

THE WHITE COMPANY

CLEVELAND



These Five Men Supervise the Estes Field Staff of Forty Senior Engineers.

Don't Judge Efficiency Service By "One Man" Results

YOU wouldn't think of using a single-cylinder engine to drive a five-ton truck. To benefit fully by the power possibilities of gasoline, you must apply it properly.

And so it is with efficiency service. To experience its full power possibilities in your business, you must not limit it to "one-man" efforts.

Estes Supervised Specialists Set New Efficiency Standards

No matter how competent the industrial engineer you employ, he has his human limitations.

He may be highly efficient as a time study specialist, but woefully weak on comprehensive study. He may be wonderfully competent in planning and scheduling, but pitifully poor in executing.

Estes service is a many men service. And every man is a specialist—a proved master of some particular branch of efficiency engineering. Back of each of more than forty senior staff men (Estes employs no "juniors") are the immense resources of the entire Estes organization—the statistics, the record files, and the vast knowledge gained during many years experience in scores of varied industries.

The Value of Versatility

Each Estes engineer is kept on a job only so long as his special skill is required. Then another specialist takes up another step in the work. And these changes are made without any break in the service.

Working directly under the general supervision of Mr. Loring V. Estes are four supervising engineers of exceptional talent. Each supervisor reinforces the efforts of each staff man in his department and works continually in the interests of the clients.

New Booklet Now Ready. A new edition of "Higher Efficiency" is now ready for mailing. Copies will be furnished gratis upon request of executives only.

Estes Service is immediately available to firms engaged in essential war production work

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"RAISE WAGES WHILE CUTTING COSTS"

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